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INTRODUCTION

This is a series publication containing translations of items of military interest from various publications of the Eastern European countries. This report contains translations on the subjects listed in the table of contents, arranged alphabetically by country.

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BULGARIA

JURISDICTION OF THE MILITARY COURTS IN BULGARIA

[Following is the translation of an article by Podpolkovnik St. Kunchev and Mayor B. Yotov in Sotsialistichesko Pravo (Socialist Law), No 9, Sofia, November 1960, pages 45-53]

I. In compliance with and as a follow-up of the provision of Article 59 of the Constitution of the People's Republic of Bulgaria, the Law on the Organization of the Courts provide for the existance of general as well as special courts. The amendment to Article 2 of the same law, of 1 January 1957, abolished the then existent special courts--the transportation court and the military court at the Ministry of Internal Affairs--and left only the military courts [as special courts]. The cases handled by the transportation court were put under the jurisdication of the regular courts, while those handled by the military court at the Ministry of Internal Affairs were put under the jurisdication of the military courts.

The military courts, whose existence is justified by the special character, organization, and discipline of the Armed Forces, are part of the unified court system of the People's Republic of Bulgaria. They are based on the same democratic princples as the general courst. Both fulfill the tasks placed before the judiciary organs--defense against criminal acts against the socialist social structure established in the country; against the political, labor, and other personal and property rights, and the interests of the citizens; the rights and legal interests of the state agencies, enterprises, and the other public organizations. As special courts they are, however, organs of the judiciary in the Armed Forces, called to carry on the struggle against criminal attempts to damage the fighting ability and fighting readiness of the Army, and first of all against military crimes.

The military courts fulfill these great and responsible tasks not only by way of the compulsory force of punitive repression but mainly by way of correction and re-education of those committing the crimes, and of noncomplying members of the Armed Forces.

The military courts educate the members of the Armed Forces in a spirit of honest and conscientious fulfillment of military service, in a spirit of selfless service to our socialist fatherland.

II. In compliance with the specific character of the Armed Forces, our legislator has created, in Section XXIV of the Code of Penal Procedure, additional rules which regulate the jurisdication of the military courts. The first part of the above-mentioned section determines the boundaries of the jurisdication of the special courts--i.e., jurisdiction over cases withdrawn from the competency of the general courts and now subject to the military courts.

The passing of sentences and decisions not in compliance with the rules of the special jurisdication undermines the authority of the judicial process, represents in substance a violation of the socialist legality, and in the last analysis affects the rights and interests of the citizens. However, quite frequently the general courts--people's or okrug--owing to an incorrect interpretation of the provisions of the special jurisdiction, or to negligence, deal with cases subject to the jurisdiction of the military courts. In some instances the latter have also dealt with cases outside the boundaries of their competence. These are sufficient grounds to justify the necessity of clarifying the basic problems of the jurisdiction of the military courts.

III. In determining the competency of the military courts, the legislator has been guided above all by the membership of the wrong-doer in the Armed Forces--i.e., the personal aspect lies at the basis of their jurisdiction.

According to the provisions of Article 294, ff. of the Code of Penal Procedure, the military courts have jurisdiction first of all over cases involving crimes--military or nonmilitary--of general as well as private character, which are committed by members of the armed forces and volunteers (volnonaemni) during their service in the Armed Forces, as well as by employees of the Ministry of Internal Affairs during the time of their service there.

The Code of Penal Procedure includes within the competency of the military courts the following cases as a supplement to the above basic criterion: a) those involving crimes

committed by associates of the subsections of the Ministry of Internal Affairs for reasons and in connection with the fulfillment of tasks entrusted to them; b) those involving military crimes committed by reserve officers who have been granted the right to wear military uniform; c) those involving all crimes committed by civilians in complicity with members of the Armed Forces or with volunteers and only as far as military crimes committed by them in complicity with the persons listed under "b" are concerned; and d) those involving crimes of "noninforming" and "concealment," committed by civilians in connection with all crimes subject to the jurisdiction of the military courts.

IV. The Code of Penal Procedure, uses the terms "member of the Armed Force," "volunteer," and "employee of the Ministry of Internal Affairs," but it does not define these terms. The definition is deduced from other legislative acts.

1. A member of the Armed Forces, according to Article 9 of the Law on Universal Military Service in the People's Republic of Bulgaria, is a person on active military duty in the Armed Forces of the People's Republic of Bulgaria. According to the same test, such is the service of the generals, officers, the sargeants and master sergeants serving beyond the regular term of duty, and all sergeants, soldiers, and trainees (kursanti) doing their regular military service. The Armed Forces, according to Article 4 of the same law, consist of the People's Army and the armed forces at the Ministry of Internal Affairs. Consequently, the two basic groups--the cadre and those doing their regular military service in the Armed Forces--are members of the Armed Forces.

The Set of Rules on the officers' service allows a deviation from the above rule, as follows: officers sent to work in civilian agencies, such as the Voluntary Organization for Assistance in Defense (DOSO), Chair "22" at the higher educational institutions, and elsewhere, where they perform tasks in accordance with their officers' titles and functions, are considered as being on active military duty and have the capacity of members of the Armed Forces, although they do not belong [technically] to the Armed Forces.

Members of the Armed Forces are considered mobilized reserve from the moment of the declaration of the mobilization to the moment of their discharge from military service (Article 117 of the Law on Universal Military Service).

"Temporary service in the Armed Forces" means the period from the moment of enlistment in the Armed Forces to the moment of discharge. In view of this, it is of important practical significance in determining the jurisdiction of the military court to define precisely the initial and final moment of service, and clarify the terms "enlistment" and "discharge."

As far as the regular draftees are concerned, their enlistment beings from the day of their acceptance at a recruiting center, specified by the military district (Article 27 of the Law on Universal Military Service). They are considered members of the Armed Forces from this moment on, although they have not as yet entered the barracks and are not yet fulfilling concrete obligations in connection with their military service.

The final moment of regular military service is the day on which a member of the Armed Forces receives s document for his discharge [and transfer] into the reserves. Usually the receipt of such a document coincides with the expiration of the term of regular military service established by the Law on Universal Military Service. However, it is possible that the moment of discharge may not coincide with the expiration of this term. Article 26 of the Law of Universal Military Service empowers the Minister of National Defense and the Minister of Internal Affairs to keep individual members on temporary military service or in individual detachments up to three months after the expiration of the established term in case of necessity.

The initial moment of active military service of the officers begins on the date of the order of the Minister of National Defense or the Minister of Internal Affairs enlisting them. The final moment is the day on which an officer discharged by a ministerial order hands over his functions and is discharged by an order from the detachment or agency in which he has served.

The enlistment of those who serve beyond the regular term of duty--sergeants and master sergeants on active military duty--begins on the day set in the order of the commander of the detachment. The same are discharged from military service from the moment that they hand over their functions, which may be 20 to 30 days after the date of the discharge order.

We must point out that some of the general courts incorrectly limit the criterion "term of duty" to the time during which the member of the Armed Forces directly fulfills official functions. As we pointed out above, the term "term of duty" is much broader and it determines in fact the limits of the period during which a given person has the capacity of a member of the Armed Forces. Consequently, the military courts have jurisdiction not only over cases concerning crimes committed by members of the Armed Forces during the exercise of their official duties but also over those concerning crimes committed during rest periods, furloughs, and sickleaves, as well as in case of non-presentation, desertion, commitment to a disciplinary-corrective unit, etc.--i.e., during the period when they have the capacity of members of the Armed Forces. In support of this view, we must also point out that wherever the legislator has wished to limit the jurisdiction of the military courts to crimes committed during the fulfillment of official duties, be mentioned this explicitly. Thus, Article 297 of the Code of Penal Procedure, referring to associates of the Ministry of Internal Affairs, speaks only about crimes committed by the latter "by reason of and in the fulfillment of" tasks entrusted to them.

The practice of the military section of the Supreme Court as well as of the military courts of first instance includes in the category "members of the Armed Forces' the reservists called for training and check-up courses. The reason for this is that during that time they wear military uniforms and have military rank, and their entire activity is based on military regulations and on the orders of the respective command. These considerations are obviously correct, but making the reservist equal during the above-mentioned courses to members of the Armed Forces does not find support in any normative act. The Law on Universal Military Service does not contain any explicit provision from which such a conclusion could be deduced. In our opinion, it is necessary to include in the Law on Universal Military Service, de lege ferenda, a provision making the reservists equal during training and check-up activities to members of the military forces, as the legislator has done with regard to reservists at the time of mobilization (Article 118 of the Law on Universal Military Service).

2. The definition of the term "volunteer" is given in Article 18 of the Law of Universal Military Service. These are civilians serving in the Armed Forces. Unlike the members of the Armed Forces, they do not have military positions

or military ranks. Their rights and obligations are defined by the Code of Labor. The tasks which they perform in the Armed Forces may be of an administrative, economic, or other character. Consequently, "volunteers" are all workers and employees who are not members of the Armed Forces but are employed in the detachments and offices of the subdivisions of the Armed Forces as well as in the various economic, commercial, and other enterprises and organizations attached to them, such as maintenance service, public mess halls, and others.

Everything referring to the definition of the term "temporary service" of the members of the Armed Forces is also valid for the volunteers, whereby the initial and final moment of their service is determined by the Code of Labor.

3. Employees of the Ministry of Internal Affairs are such persons, civilians or those in uniform, who occupy civil service positions in the subdivisions of the same agency. The appointment and discharge orders represent the initial and the final moments of their service in this capacity.

As to employees in the fire-protection service of the People's Republic of Bulgaria, not all of them have the capacity of employees of the Ministry of Internal Affairs. These are, according to the Ukaze on the Fire-Portection Service (PPO) in the People's Republic Bulgaria (Izvestiya, No 66, 1958): employees of the Fire-Protection Administration at the Ministry of Internal Affairs, those of the fire-protection school, the employees of the department of fire-protection service at the Okrug Administrations of the Ministry of Internal Affairs, and the inspectors of this service at the urban and rayon administrations of the Ministry of Internal Affairs. The civil service employees of the fire-protection service at the people's councils and those protecting individual points are not considered employees of the Ministry of Internal Affairs, because they are appointed and discharged, as well as managed by the respective organs to which they are attached, although they have the same rights and obligations as the other employees of the fire-protection service.

The legislator made an exception from the above-mentioned rule. According to the Ukaze of the People's Militia (Izvestiya, No 25, 1955), the latter consists of a general and a departmental militia. The employees of the departmental militia are not on the Permanent payroll of the Ministry of Internal Affairs but are appointed in accordance with the

payroll of the enterprises and the objects they supervise and are maintained by the funds provided in the budgets of the latter. Considering, however, that they are under the leadership and control of the organs of the People's Militia, and that they have the rights and obligations of the employees of the general militia within the objects they supervise, the legislator has includ3d them in the category of "employees of the Ministry of Internal Affairs."

4. In their struggle against crime, the organs of the Ministry of Internal Affairs rely on the help and cooperation of the entire population. However, in order to prevent and discover drime, in some cases they entrust special tasks to individual citizens who are not employees of the Ministry of Internal Affairs. These are collaborators of subdivisions of the Ministry of Internal Affairs. Considering that only in the fulfillment of their entrusted tasks is, the activity of the collaborators directly connected with the successful carrying out of the undertakings of the organs of the Ministry of Internal Affairs in the struggle against crime, the legislator found it advisable to make them responsible to the military for crimes committed only in connection with and for reasons of the fulfillment of their entrusted tasks.

5. Some officers may be permitted by ministerial order to wear military uniform after their discharge and transfer into the reserves. This creates certain rights and obligations which equate them to the officers on active duty as far as the wearing of uniform is concerned. For this reason, cases concerning military crimes committed by those persons in connection with wearing amilitary uniform are within the competency of the military courts.

V. The numerical strength of our Armed Forces is relatively small. It is limited not only by the special clauses of the Paris Peace Treaty of 1947 but most of all by the manifold reductions carried out by the people's government aimed at lessening the international tension and consolidating peace. Therefore, some of the young people cannot have their regular military service in the Armed Forces. They perform their military duty in the Labor Service. They, as well as the cadre--officers and sergeants of the subdivisions of the Chief Administration of Labor Service (GUTP)--are not members of the Armed Forces in the meaning of Article 9 of the Law on Universal Military Service. Considering, however, that the discipline and internal order in the subdivision of the Chief Administration of the Labor

Service are regulated by the basic military statutes, the legislator, by special ukaze (Izvestiya, No 26, 1951), has equated the members of the Labor Service with the members of the Armed Forces only with regard to their criminal acts. By an explicit provision, contained in Article 1, paragraph 2 of the same Ukaze, cases concerning crimes committed by the entire personnel of the Shief Administration of Labor Service (labor servicemen, officers, sergeants, and volunteers) were transferred to the competency of the military courts. Unfortunately, the Code of Penal Procedure, as a more recent legislative act, did not include the provisions of that ukaze. The latter, which regulates special jurisdiction, refers to the VSZ [not identified], which has been repealed. In our opinion, it is necessary to include in Section XXIV of the Code of Penal Procedure a separate provision repeating the meaning of the quoted ukaze.

VI. The members of the Armed Forces and the volunteers may commit several acts which represent a continuous, or complex crime. The characteristic of these crimes is that they are not commited at one time but over a more or less extended period of time. This makes it possible that these crimes: 1) are begun by the person before he entered the service and are completed after he has become a member of the military forces (or volunteer); 2) are begun and completed while he is in the service; and 3) are begun when he is in the service and completed after he is discharged. The question arises as to which court will have jurisdiction over such crimes. As to the second hypothesis, Articles 294, ff. of the Code of Penal Procedure give a categorical answer: the military court is the competent one. The Code of Penal Procedure has no indication as to the anser to the first and thir hypotheses. However, judicial practice has created a criterion analogous to the provision of Article 20 of the Code of Penal Procedure, which regulates the rules on local jurisdiction. Cases concerning continuous, continuing, and complex crimes are subject to the jurisdiction of the court that is competent to deal with acts which complete a given crime. It follows logically that under the first hypothesis the military court is the competent one, while under the third hypothesis it is the regular court. Confirming the practice of the first-instance courts, the Supreme Court, Third Penal Section, supported this interpretation in its Decree No 28 of 17 June 1953. This viewpoint is clearly expressed in Decree No 16 of 1960 by the Sofia Military Court concerning case No 16, 1960. After having established that a person committed seven acts constituting a continuing

crime according to Article 193 of the Penal Code, the first four committed by him as a member of the Armed Forces, and the latter three as a civilian, the military court dismissed the case and referred it to the jurisdiction of the people's court.

VII. In order to carry out successfully the struggle against criminal acts against the interests of the Armed Forces, the legislator has transferred to the furisdiction of the military courts cases that concern crimes committed by civilians in complicity with members of the Armed Forces and volunteers, as well as in case of concealment and non-informing by civilians of crimes subject to the jurisdiction of military courts. Judicial practice offers cases where criminal prosecution against members of the Armed Forces or volunteers have been dismissed--for example, on the basis of Article 6, letter "a" or "e" of the Code of Penal Procedure, Article 128 of the same, Article 7 or 11 of the Penal Code, or because consent to proceed was not given by the respective commander who had assumed that the case involved only a discip;inary violation by a member of the Armed Forces. If a criminal prosecution against a civilian is not dismissed, which court will be competent to deal with the case? A correct application of the provisions regulating the special jurisdiction suggests that the military court is the competent one in such a case. The fact that the criminal prosecution against a member of the Armed Forces or volunteer is dismissed, does not remove the complicity itself, etc. It was a legal category at the time the crime was committed and the procedural rules are not in a position to remove it as such ex post facto.

When it is established during the court proceeding during the initial charge of complicity, noninforming, or concealment by civilians in connection with crimes under the jurisdiction of military courts that the crime was committed only by civilians, the case should be dismissed and referred to the jurisdiction of the regular court. As the Supreme Court Military Section, ruled in its Decision No 113, 1960: "In case the first-instance court has assumed that the members of the Labor Service are not at all responsible for an accident and only the civilians are responsible for it, the case with regard to the same is correctly dismissed and referred to the regular court."

"Complicity" also presents other problems connected with special jurisdiction. It is possible that a crime committed

by a civilian in complicity with a member of the Armed Forces or volunteer may be only a part of a continuing crime or that his act represents only one of the elements of a complex crime. In these cases, only the civilian's part of the crime is committed in complicity with a member of the Armed Forces or volunteer. Is the military court competent to deal with a case also involving the remaining criminal action of the civilian as long as the member of the Armed Forces has not taken part in it? Considering that the norms of procedure should in no case hinder the correct application of the material law, it should be assumed that the military court is competent to deal in toto with the crime of the civilian as long as a member of the Armed Forces or volunteer participated in committing even one part of it. To accept the opposite would mean in all these cases that the unity of the crime would be artificially split up.

VIII. In case more than one crime is committed by the same person, Article 23 of the Code of Penal Procedure rules that the case should be considered by the court that is competent to deal with the most serious of the crimes. It is possible that a person has committed several crimes, some of them as a civilian and others as a member of the Armed Forces or volunteer. Do the provisions of Article 23 of the Code of Penal Procedure apply in such case, and does it follow that one court should deal with all the crimes? The answer con only be negative. Articel 23 of the Code of Penal Procedure, as the Supreme Court Military Section, has correctly ruled in its Decreee No 10 of 1958 is applicable only in the case of jurisdictional concurrence between the regular courts and the special courts.

IX. The military court is competent to deal jointly with the criminal responsibility of the defendants and the civil claims presented against them for damages resulting from the crime. If the criminal prosecution is discontinued or the civilian claim has not been presented on time or has not been considered because of its complexity, the military court is not competent to deal independently with the civil claim as a separate claim procedure. In such cases, the civilian claim is presented before the general courts.

X. Cases concerning overdraft by the accounting workers of the departments of the Ministry of National Defense, the

Ministry of Internal Affairs, and the Labor Service are tested by the military courts according to Article 299, paragraph 2 of the TPK [not identified]. It must be pointed out that all overdrafts, regardless of the official position of the accounting workers and other persons charged with the overdraft, are treated by military courts of first instance. The reason for this jurisdiction is the fact that the department in which the accounting worker has worked is serviced by a special court. Consequently, for a case concerning an overdraft to be subject to the jurisdiction of a military court, it is necessary that the defendant be employed during the time of his accounting activity in one of the above-mentioned departments. The Supreme Court, Military Section, holds the view that the military courts have jurisdiction over all formal acts charging overdraft signed by the organs of the departmental control at the Ministry of National Defense, the Ministry of Internal Affairs, and the Labor Service, regardless of whether or not the defendant was employed by any of those departments during the time of the accounting period. In our opinion, this view cannot be accepted; it leads to several practical difficulties in dealing with and solving cases of overdraft. According to the Supreme Court, formal acts charging overdraft involved the accounting workers of the former "Gorstroy" and "Vodstroy" for a period when these enterprises were not part of the Labor Service where the formal acts have been signed by the examiners of that department, are treated by military courts. Should one look for criminal as well as material responsibility, then the formal acts charging overdraft should be sent to the civil prosecutor's office, since the military prosecutor's office and the military court are not competent to look for criminal responsibility of persons for a period of time during which they were not employed by the Labor Service. Should the criminal prosecution be discontinued, however, the formal act charging overdraft should be sent to the military court. Moreover, if third persons are involved in the overdraft, they will be responsible, according to the fate of the chief accounting workers, be it--before the general courts or the military courts. Obviously, it is a more acceptable and stable criterion to determine the jurisdiction over cases involving overdrafts not on the basis of the membership of the examiner in the departments of the Ministry of National Defense, the Ministry of Internal Affairs, or the Chief Administration of Labor Reserves, but on that of the accountant worker.

XI. The military courts also have jurisdication over cases instituted for purposes of rehabilitation, conditional release before expiration of the term, and grouping of sentances, whenever they are competent to do so. The military courts deal with cases involving rehabilitation in the following instances: 1) when they have passed sentences that are being appealed; 2) when they have grouped sentences (the most sever punishment must be imposed by a military court); and 3) when the applicant is employed by the Armed Forces or Labor Service, regardless of the court which has passed the sentence.

The minitary courts decree a conditional release before the expiration of the term when they themselves have imposed the sentence as well as when they have grouped the sentences.

XII. The violation of the rules of special jurisdiction constitutes an absolute (unconditional) cause for repealing the sentence (or decision). Expressing the continuous practice of the Supreme Court of the People;s Republic of Bulgaria, the First Criminal Section of the same stresses in its Decision No 812, 1959: "The special jurisdiction has been violated...and it is of a public character. The violation is particularly essential when the sentence and the decision cannot have the force and significance of acts consonant with the law and must therefore be invalidated" (see also Prof St. Pavlov, Penal Procedure of the People's Republic of Bulgaria, Sofia, 1959, pages 240 and 863).

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POLAND

SUPREMACY IN THE AIR:

CHARACTERISTICS OF MODERN MEANS OF AIR ATTACK

[Following is the translation of an article by Podpułkownik Nawigator Magister Cz. Gagajek in Wojskowy Przeglad Lotniczy (Military Aviation Review), Vol XIV, No 4, Warsaw, April 1961, pages 9-17.]

The increased importance and complications of the problem of air supremacy in the present day has been influenced by the following basic factors:

(1) The thoretical unlimited growth in the effectiveness of means of destruction.

(2) A wide adaptation of pilotless means of air attack.

(3) A manifold improvement of the fighting characteristics of the modern piloted airplanes.

The drama played out in August 1945 in the Japanese cities of Hiroshima and Nagasaki constituted a great, radical step which changed all previous views in the field of strategy, operational art, and tactics. The appearance of nuclear weapons is the basic factor which basically influences the previous principles of conducting the battle for air supremacy.

The heaviest bombs used during World War II weighed between 5 and 10 tons. During the greatest air attacks, in which a thousand bombers took place, bombs were dropped with a combined weight of about 5,000 tons. The first atomic bomb dropped on Hiroshima had an explosive force equal to 20,000 tons of TNT. Thus, even at the beginning of the nuclear epoch one bomber could drop a load whose explosive force was four times greater than the explosive force of conventional bombs transported by a thousand bombers.

The first hydrogen bomb, tested in March 1954, released explosive energy equal to 20 million tons of TNT -- a thousand times more than the Hiroshima bomb. Such bombs can destroy the largest cities. A few such bombs dropped on the proper objects could paralyze the economic life of a whole country, and the radioactive fall-out could paralyze the life of the people.

The threat of nuclear weapons increased even more when pilotless means of attack were adapted to carry these weapons.

Pilotless means of air attack appeared already at the end of World War II (German V-1 and V-2). However, technical faults limited their use to the destruction of large targets such as London.

As a result of the further development of the technics of distant guidance and rockets after World War II, the ground-to-ground class of air-attack weapons, was enlarged by the addition of airplane- and ballistic missiles, which have different purposes and different battle characteristics.

Inasmuch as airplane-missiles can reach a speed close to that of speed-of-sound airplanes and can be fought by these air= planes, the ballistic missiles, on the other hand, can develop speeds of up to 20,000 km per hour and cannot at present be destroyed in the air after being launched. The reach of these missiles divides them into tactical-operational and intercontinental ranges from less than a hundred km (for example, Honest John), to several thousand km (Atlas and Titan), to even more than ten thousand km (Soviet tests in the Pacific exceeded 12,000 km).

The high degree of invulnerability of the launched missile makes it possible to implement a surprise attack on every object of the enemy without regard to the strength and means of anti-rocket defense. This attack can be carried out at any time of year or day without regard to atmospheric conditions. The rocket-launching platforms are situated in areas much smaller than those needed for modern airplanes. They are, therefore, easier to cover, disguise, and defend. Furthermore, the platforms for the missiles of the smaller class are highly manauverable, not to speak of the possibilities of installing them on ships and airplanes. They are thus mobile objects of small dimensions, hard to uncover and locate.

In the face of these unquestionable fighting qualities, the rocket weapon found first place in the aresenal of modern means of battle and became the chief means for the delivery of the weapon of mass destruction.

However, the rocket missiles without ground service and a planning and directing center cannot fulfill their task which is to hit a target.

The exactness of the hit is a very basic problem connected with the adaptation of rocket weapons. In this field very good results have been achieved lately. The Soviet rocket technique particularly has achieved unprecedented precision. The degree of accuracy of Soviet rockets is less than 0.15 per thousand, of the distance of the target (at a distance of 12,000 km deviation from the intended point was 2 km), while Western sources not long ago considered a deviation of 0.5% of the length of the route as very good.

The problem of accuracy is, however, connected with the performance of many complicated computations and with the necessity of taking into account many factors having an influence on the flight of the rocket. It is necessary to possess exact geodetic data, to compute precisely the azimuth angle (taking into consideration the rotation of the earth), to regulate exactly the pull of the rocket motors and the speed of the missile before it reaches the ballistic track, and finally to take into consideration changes in the atmospheric conditions (density and temperature of the air) and many of the other factors which go into computation of the flight of the missible. These technical difficulties complicate the use of rocket weapons in conditions of fast-changing battle situations, namely against objects of small dimensions, objects insufficiently recognized and located, and mobile objects which change often their position.

It is not always possible to substitute the need for exact computations with an increase in the explosive power of the warhead, as is being suggested by certain military experts. The position of friendly forces may not permit this increase, or the object to be attacked may not be worth it.

It is also necessary to remember that the mechanism of the rocket missile always works according to a previously established program and is not in a position to react to the unforeseen situation. The ballistic missile cannot be returned from its track, it cannot be re-aimed on other objects, or adapted to the actual existing situation (for example, when friendly forces have arrived on the target area).

These negative characteristics of rocket weapons, which can be kept to a minimum under missile-range conditions, may show up sharply in war conditions.

Alongside the fast-developing rocket weapons, we observe the further development of piloted airplanes.

The sharp qualitative jump in the development of aviation which took place after World War II was a result of equipping airplanes with jet motors and later, in the beginning of the fifties, of crossing the sound barrier.

Parallel with this came a change in the equipment and armament of airplanes.

The range of modern war planes has increased several times over the ranges of airplanes at the end of World War II. For example, the spped of fighter planes rose from 600-700 km/hour (Spitfire, Mustang, Messerschmitt, Jak-9, La-5, and others) to 1,500-2,500 km/hour (F-102, Super Mystere, Saab-J-35, P-1B, F-104, F-105, and others), or a three-to fourfold increase. The ceiling of these airplanes rose 1.2 to 1.5 times and is now about 20,000 meters.

The speed of bombers increased from 400-500 km/hr to the speed of sound -- 1,000-1,100 km/hr (B-47, B-57, B-52, Vulkan, Victor) -- and even beyond the speed of sound, for example, the B-58 (around 1,500 km/hr.) The average increase in speed here is 2-3 times. At the same time the operational ceiling of bombers has also increased (to 13-15,000 meters), and so has the range (to over ten thousand km as in for example the B-52 to over 13,000 km, not taking into account the possibility of midflight refueling).

Beside the bombers, the fighter planes were adapted for carrying bombs and for attacking ground objects; these are the so-called fighter-bombers, which do not differ in their ranges from typical fighter planes (for example, the F-100C, F-105C). These planes constitute, because of their ranges (particularly speed and ceiling), a group of piloted means of air attack with the greatest battle possibilities.

Another type of plane is the light assault-fighter designed primarily for direct support of ground forces (Fiat 91G), which can also be used with great success for attacking from a low altitude airfields and other air installations laying within reach of its tactical radius of activity (around 250 km).

The modern radiolocative equipment of airplanes permits them to be in action in almost all conditions of atmosphere and in any time of year or day.

The traditional shooting armament of fighter planes is replaced by directional missiles of the air-to-air class; this greatly increases the fighting possibilities of these planes by increasing the likelihood of a hit (to 95% when firing three missiles).

Instead of bombs, the bombers, fighter-bombers, and assault-fighters are equipped with directional air-to-ground missiles, and even (the bombers) with ballistic missiles for ground objects. All this increases the possibility of successfully attacking ground objects, since the attack can be carried out from a great distance (to 600 km); at the same time the safety of the attacking planes is increased. Moreover, almost all airplanes equipped with bomber armament are adapted for the transportation of weapons of mass destruction.

It is, therefore, necessary to assert that at the present time and for a long time to come piloted airplanes and also rocket weapons will continue to be an important means of air attack. Their operational effectiveness is assured by their modern battle characteristics.

Air Supremacy under Present Conditions

In face of the serious threat which the present means of air attack create for the fighting armies as well as for the whole

nation, it is not difficult to establish the importance of supremacy in the air.

It is necessary, however, to examine in this place the term "air supremacy" under present conditions. Can we today speak of winning air supremcay in battle or of creating a situation which would minimize the threat from the air and insure freedom of action to one's own armies?

Is it possible to gain air supremacy in a limited region and in a limited period of time? In what way is it necessary to organize and conduct the battle for air supremcay? These are the basic q uestions which present themselves in connection with the new conditions.

The battle for air supremcay reduces itself to the destruction and disablement of the enemy's means of air attack, as well as his means of air defense. The means of air attack constitute in every situation a potential threat from the air for the armies in the operational zone, as well as for rear targets. They can paralize and disorganize the battle operations, as well as economic activities. The enemy's air defense limits the freedom of action of one's own air force and thus diminishes the possibilities of effective support from the air for the fighting armies.

During World War II the only means of air attack were basically only airplanes carrying conventional weapons (we do not take into account the rocket missiles V-1 and V-2 and the two atomic bombs used at the end of the War, since their use did not have an influence on the changing the views and principles of conducting a battle for air supremacy). For this reason the Second World War could serve as a starting basis for carrying out an analysis of conducting a battle for air supremacy under present conditions.

We can state in general that the battle for air supremacy was begun by the Hitlerite Germans several years before the start of World War II, when they began to increase the quality and quantity of their air fleet. This superiority permitted the Germans (in addition to their taking advantage of the element of surprise) to gain from the first day of the war operational predominance and strategic predominance on all fronts (Poland, Denmark, Norway, France, Soviet Union). This predominance was achieved by destroying and disabling airfields by massive strikes on these airfields. These strikes were so surprising and effective that the sides attacked were not in a position to carry out retaliatory attacks. In this way, for a long period of time the Germans possessed undisputed supremacy in the air, which was no doubt one of the basic factors of their initial successes in the whole of Europe.

Of course, this supremacy did not completely exclude air activities by the attacked side. This activity, however, was little effective, limited only to defensive activities, and had no effect on the course of ground operations.

At present, in case of a conflict between the two camps would it be possible to gain a similar supremacy in the air during the initial period of the war? It seems not.

We are inclined to express such a view by the high degree of military preparedness of both the means of defense and retaliation, as well as by the vitality and effectiveness of these means.

It is accepted (and this is accepted in official views) that in the first surprise attack the aggressor will direct his rockets and planes with nuclear cargo on the bases and launching sites of ballistic missiles, on the airfields of bombers and fighter-bombers, on the places where the weapons of mass destruction are stored, and on the targets in the air-defense system. [See Note.] (ground-to-air missile sites, sentinels of the radar system, commanding posts, and others), counting on their destruction and disablement. Will he succeed in this and prevent a retaliatory strike?

([Note:] The use of the term "air defense" does not correspond to the demands which are now put on such defnese.)

In order to gain a greater element of surprise, the aggressor in the first wave of the attack will probably use ballistic missiles. At present there are no ways of destroying them in flight, but there exists the possibility of their early discovery while they are still inflight, and bringing in motion the retaliatory means, sending them out in the direction of the aggressor before his missiles have reached their assigned goal. Thus even when hitting their goal, the missiles of the aggressor will not completely fulfill their tasks, for the retaliatory missiles will already be in the air and they will reach their assigned goals on the territory of the aggressor only a little later. In this way the "settlement of accounts" will take place, and both sides will be in similar situations.

Even in case the complicated system (radar) of distant detection and warning is disappointing the retaliatory strike will still take place since first, since not all attacked bases will be effectively hit, and not all bases will have been discovered and located, especially when they are dispersed over a wide area). With manned bombers and pilotless guided missiles, the possibilities of effective counter action are incomparably better, since these can be very effectively fought in the air with modern air defense.

We may draw from the above the conclusion that the real capacity of executing a retaliatory strike will make it impossible for the aggressor to achieve any essential supremacy in the air which would be decisive for the outcome of the war.

A present-day war will not end with one airplane-rocket strike but will be decided by further operations in which all kinds of armed forces take place. Operations will take place on land, on sea, and in the air.

How does the problem of air supremacy look in the course of these operations? Can we speak of the possibility of gaining supremacy in the air in the course of these operations and assure this supremacy to the fighting armies? Here again the answer is no. This conclusion is drawn from the battle characteristics of modern means of air attack, both pilotless and piloted.

In World War II operational supremacy, not to speak of tactical supremacy, was achieved as a result of pertinent, decisive actions by all branches of the air force; these actions were carried out either in the form of operations for the purpose of gaining supremacy in the air, or in the form of great air battles conducted by fighters (Moscow, Kursk, Kuban, "Battle of England"). The achievement of this supremacy was possible thanks to the destruction and disablement of the basic air forces of the enemy in the given region, at least for the length and width of one operational front, with the purpose of preventing the enmy from regenerating his air froces until the end of the operation -- 12 to 15 days. Besides the air operations conducted for this purpose by the front air forces, the strategic air forces carried out attacks on airplane factories, on air bases deep inside the enemy, and on communications, thus isolating the zone of operational activities from the flow of fresh forces.

The experiences of the War show that such an elimination of a limited area with average dimensions of 200 by 400 km and gaining and keeping air supremacy of its air space for a given period of time was possible. An advantageous relationship of the air forces was achieved in this region; it made possible the successful execution of their tasks by the ground forces, as well as by one's own air forces, which could effectively support the operations of the ground forces.

Under present conditions, even if we assume that we shall succeed in destroying the means of attack of the enemy in a similar area, this will by no means mean an improvement in the relationship of forces; neither will it assure freedom of action of one's own air forces in the enmmy's terrain nor diminish the danger from the air for one's own forces. The enemy possessing modern means of air attack on adjacent regions will be in a position, without the need of executing a maneuver with any implements, to strengthen at any time the most exposed direction and execute successful attacks on the armies without a significant operational delay. It is necessary to remember that previously tens or hundreds of airplanes were necessary for such a purpose, while today this can be accomplished by one rocket or one very fast airplane with an atomic cargo, for which an expansion of 200 by 400 km does

not constitute any obstacle. Freedom of operation of the air forces over the operational terrain of the enemy can be effectively hindered either by his ground anti-air means or by his fighter planes brought over from the adjacent area.

From the above, the conclusion can be drawn that it is difficult to speak today of gaining tactical or even operational supremacy on the previous scale. It is also difficult to speak of limited operations with rockets or airplanes carried out for the purpose of destroying or disabling the enemy's means of air attack. This battle must be conducted without interruption at least for the entire width and length of the whole theater of war activities, with greater and lesser intensity (dependent on the operational situation), according to a monolithic plan worked out at the highest stage of the supreme command.

As the previous considerations have shown, under present condition the meaning of the notion "supremacy in the air" as well as the forms and means of conducting battle to gain this supremacy has changed.

Only on a strategic scale is it possible to speak now of air supremacy; such a supremacy is achieved only when the enemy's stocks of nuclear weapons, his industrial plant producing these weapons, and the means of their delivery are destroyed. Only in such a situation can we say that the enemy, not having any more possibilities of regenerating his forces, will not be in a position of successfully counteracting the land forces and disturbing the economic life of the country. This means that in such a case we should possess air supremacy, which could simply be called absolute supremacy. Such a state will practically mean the end of the war and the capitalation of the enemy.

In the initial phases of the war and in the course of further military actions up to the time of gaining supremacy on a strategic scale, we can merely speak of actions with the purpose of destroying and disabling the enemy's means of air attack, as well as his anti-air and anti-rocket defenses.

It seems, then, that in view of this new auality it is difficult to find a term which will agree more with the basic content of the modern battle for achieving supremacy in the air. The other terms frequently met with like "preponderance in the air," "the battle to improve the relations of forces" are equally unsuited to describe this new auality, since in both cases these terms connote a quantitative state which is basically false. Equally, the term "initiative in the air," connoting an initiative possessed exclusively by airplanes, does not exhaust the factual content of the whole battle in which the basic role is played by rocket missiles, which, after al, do not "fight" in the air.

Moreover, it is difficult to define under present conditions a situation about which we could state that it means the possession of "initiative in the air." It seems that in the course of

military actions, so long as supremacy on a strategic scale is not gained, it is impossible to speak of some intermediate states or condition such as the possession of supremacy or the initiative in the air in this or that limited region or for this or that limited period of time. It is only possible to speak of a constant battle with the enemy's means of air attack and with the means of his anti-air and anti-rocket defenses. The purpose of this battle is the creation of such a situation in which the rocket and air forces will manage to come out of each encounter with a stronger "blow" than that administered by the enemy and paralyze the enemy's means of air attack to such a degree as to make it possible for one's own forces to successfully develop military operations and for the country to pursue economic activities.

This battle, in view of its importance and continuity, is not a separate task of limited forces and means, but is a basic, organic part of the battle conducted by all the armed forces. This battle will be conducted both in the form of large, specially organized operations by rocket and air forces and in the form of military operations conducted by particular units and by combinations of all kinds of armed forces.

This battle will embrace:

1) Blows of rocket forces and air forces against the enemy's means of air attack and against his mass-destruction weapons, as well as against his means of anti-air and anti-rocket defense.

2) Anti-air and anti-rocket defense of one's own forces on the front and in areas of the country.

3) Operations of paratroopers against the enemy's means of air attack and against the objects of his anti-rocket defense.

4) Radioelectronic counteraction.

5) Air and radioelectronic reconnaissance.

6) Disguised operations, as well as a number of other undertakings connected with passive defense against weapons of mass destruction.

Operations for the purpose of destroying and disabling the enemy's means of air attack and his means of anti-air and anti-rocket defense are indispensable conditions for achieving absolute supremacy in the air and for reaching the final goal of the war -- victory.

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METHOD OF INTERCEPTING TARGETS AT LOW ALTITUDE

[Following is the translation of an article by Kapitan Nawigator J. Witek in Wojskowy Przeglad Lotniczy (Military Aviation Reviews), Vol XIV, No 4, Warsaw, April 1961 pages 19-24.]

In this article I shall discuss one of the methods of intercepting air targets at low altitudes from a turn or half-turn.

The interception course is set to the point of outstrip (point of the beginning of the turn or half-turn). This point lies in the plane of the target's flight at an elevation relative to the target which assures safety for the execution of the vertical maneuver (turn or half-turn). When acting from duty on the airfield, the intercepting pilot executes the flight with maximum speed to the point of beginning of the maneuver. On the other hand, when acting from a patrol zone, the flight to the point of the beginning of the maneuver is either executed according to patrol procedure or by a procedure ordered from the ground control-point through the navigator.

When coming out on the computed point at the beginning of the maneuver, the fighter pilot executes a vertical maneuver and, dependent on the tactical situation, brings the plane on the same course as or on the course conveniently intersecting the flight course of the target, assuming at the same time a starting position for the attack.

The performing of computations.

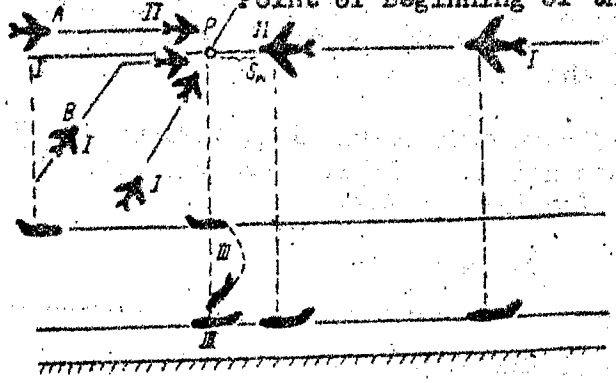
The course for interception is computed by known methods; that is, the course is to be marked to the point at the beginning of the maneuver, lying to the side of the flight axis of the target. However, the most convenient way is to bring the fighter out of the maneuver on a course counter to that of the flight of the target, somewhat to the side on a distance equal to the altitude gained in the maneuver(taking into consideration, however, the position of the sun).

The outstrip distance (S_w), that is, the distance between the fighter and the target at the moment of the beginning of the maneuver, depends on the speed of the target's flight and on the time it takes to execute the turn. This distance is computed depending on the angle at which the fighter approaches the flight axis of the target by the following formulas:

1) For courses opposite to the target or intersecting opposite the target, at an angle not greater than 60°,

a) Without taking into consideration the delay time in giving and executing the order:

$$S_w = V_c \cdot t_p$$



Graph 1. Bringing the Intercepting Fighter to the beginning Point of the Maneuver

b) Making allowance for delay time in giving and executing the order

$$S_w = V_c (t_p + t_o) + (V_m + V_c) t_o$$

where:

V_c = speed of the target;

V_m = speed of the fighter at moment of bringing it in to the attack; =

t_p = time taken to make the turn;

t_o = delay time in giving and executing the order.

2) For courses interesecting each other, at an angle greater than 60° and less than 90°, taking into consideration the delay time in giving and executing the order:

$$S_w = V_c \ (t_p + t_o) .$$

Since the delay will amount to about three seconds, only the time for the turn is taken into consideration (t_p).

Bringing the fighter on a flight course intersecting that of the target at an angle of over 45° is difficult and demands great precision, since the possibility exists of bringing the fighter past the target.

The outstrip distance is computed in advance for different interception cases and the following table (Table 1) has been made. (This table is for the Lim-2.)

Table 1

Duration of turn in seconds	Speed of flight of the target in km/hour						
	500	600	700	800	900	1,000	1,100
	Outstrip distance in km						
25	3.5	4.2	4.8	5.5	6.9	4.5	7.6
30	4.2	5.0	5.8	6.6	7.5	8.3	9.2

Work of the Navigator-Operator during the time the Fighter is brought in for the attack.

Depending on the existing tactical situation, the fighters may be brought out either on a course opposite to that of the target's flight of close to it, or they may be brought out -- to begin the maneuver -- at a point on the line of flight of the target.

In the course of bringing in the fighter for attack, the navigator-operator informs the pilot of the actual position of the target saying: "Target altitude --, course --, speed -- ."

The bringing-in for the attack from a turn or half-turn should be executed while the radar stations are working with maximum revolutions of the anetenna.

About 20 to 30 seconds before the fighter reaches the computed point of the beginning of the maneuver, the navigator-operator makes a decision as to the character of the maneuver and gives the preliminary order: "Be ready for the turn (half-turn) to the right of left."

At the moment when the fighter reaches the computed point of the beginning of the maneuver, the executing order is given: "Turn right (or left) 1200."

If the operation of bringing in the fighter for the attack is not successful for some reason and the pilot, after executing the maneuver, has not sighted the target, he should continue to bring in the fighter for the attack in the horizontal plane by one of the known methods.

Actions of the Pilot During the Overtaking Flight.

Overtaking from the turn or half-turn does not require a special retraining of the pilots. It is only necessary to have mastered the dynamics of overtaking and to have mastered the technique of flying in pairs (if two fighters are simultaneously brought in on the target).

The battle grouping of the pair can be either compact or loose, depending on the method of executing the turn. Basically, the turn is executed in close formation. If the pair makes the turn successively, it then takes place in open formation (distance in the pair on the order of 100 meters and an interval of 30-50 meters.

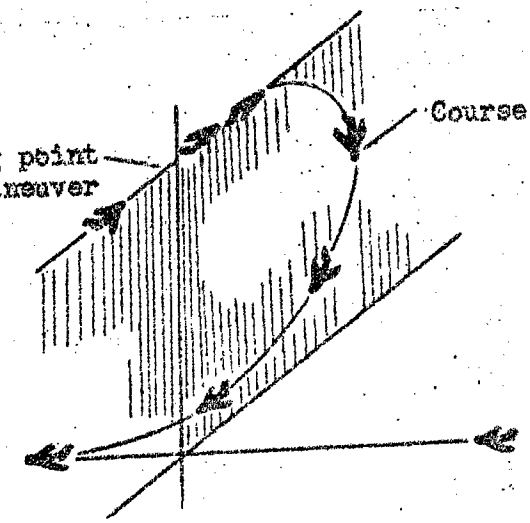
It is necessary to point out that it is easiest to have the fighters in the pair make the turn in succession.

The flight for overtaking the target is executed at the ordered altitude and with the same definite instrument speed as that used for making the turn. The speeds used in bringing the fighter into the turn are rigidly connected and are dependent upon the altitude (see table 2).

Depending on the characteristics of the fighter, a minimal admissible altitude for bringing it in for the turn and a maximal admissible instrument speed have been adopted (for example, in the adopted assumptions in table 2 they are relatively 3,500 meters and 500-550 km/hour).

After receiving the order: "Make ready for the turn (half-turn) to left (or right)," the pilots should strengthen their observation.

At the moment of receiving the order (for example): "Turn left (or right) 120°," the leading pilot, with smooth coordinated movements of the steering apparatus, brings the plane into the turn, looking at the same time for the target. Immediately after the leading pilot, the follower pilot executes the turn. The turn is accomplished without an angle of elevation, the nose of the plane being smoothly turned down. If the pilot should glimpse the target during the turn exactly on the opposite course and the target is shielded by the fuselage of the fighter, then the slowing-down of the turning process should be delayed until the target has passed.



Graph 2. Execution of interception from vertical turn on opposite intersecting courses.

It is possible to execute such a maneuver on the turning course within the bringin-in speeds for the given plane; these speeds should, however, be not greater than 500-550 km/hour. These speeds should assure free steering of the plane at each moment of the turning course.

On altitudes under 3,500 meters, only those pilots should execute the turn who have a very good mastery of the piloting technique.

The loss of altitude during the turn, depending on the type of plane, the speed, and the altitude at the moment of starting the turn, can be seen in table 2 (the data in this table are given for the Lim-2).

If the pilot does not see the target while making the turn, then the turn is executed normally, and the fighter is brought out on the necessary course and altitude. At the moment of coming out of turn, the pilot reports: "Course 270°, altitude 500 meters."

The execution of interception from a half-turn takes place when the fighters, at the moment of reaching the computed outstrip-point, have deviated greatly from the point of starting the maneuver, a deviation larger than the altitude to be lost during the turn.

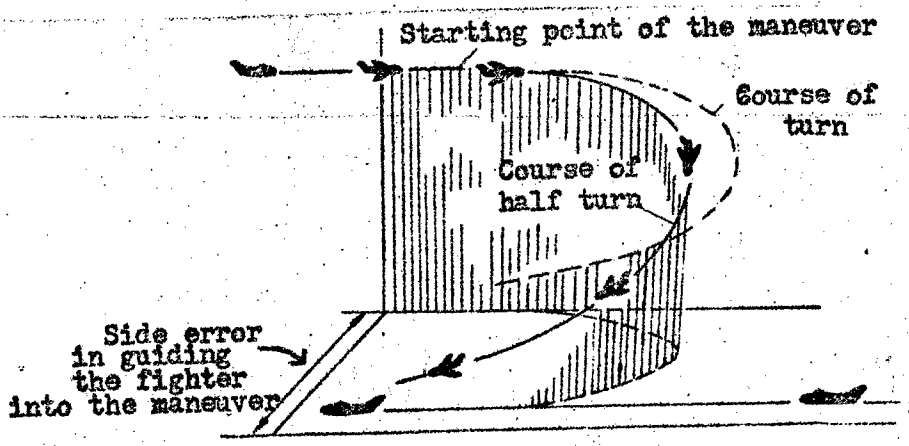
In this case, the navigator-operator, depending on the side deviation, gives the order: "Half-turn to right (or left)." The pilot's actions are the same as during a turn, with only this difference: the plane is not brought to a full turn and the drop takes place not in the course of diving but on the course of the half-turn (Graph 3).

Table 2

Altitude at beginning of turn	Speed of turn	Loss of Altitude	Duration of the turn
2,000	350	1,150	21
3,000	350	1,400	22
4,000	350	1,400	23
5,000	350	1,500	24
5,000	400	1,500-1,600	24
5,000	500	1,900	24
6,000	350	1,500-1,700	25
6,000	400	1,700-1,800	25
6,000	500	2,100-2,400	26

8,000	400	2,500-2,800	27
8,000	500	3,000-3,500	28
10,000	350	2,700-2,900	30
10,000	400	2,900-3,100	30
11,000	350	3,200-3,400	30

During interception from air patrol, the fighter is brought out to beginning point of the maneuver at large angles, close to 90° (Graph 1); it is then better the execute a half-turn than a turn.



Graph 3. Executing interception from half turn on opposite courses.

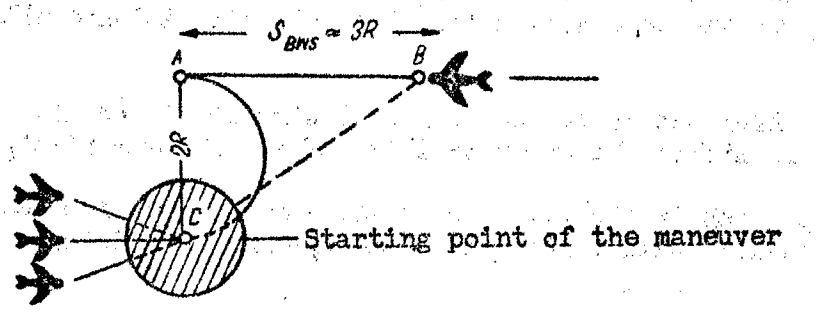
Bringing out the fighters to a convenient position of attack from a turn or half-turn is more advantageous than to bring them out to attack from a horizontal turn in horizontal flight for the following reasons:

1) Bringing out the fighters to the beginning point of the maneuver is considerably simplified, and the moment to give the order to execute the maneuver can be established with great accuracy. This is explained by the fact that, by bringing out the fighters to the attack from a horizontal turn in horizontal flight, the beginning point of the maneuver is plotted to the side of the target's line of flight at a distance equal to two radii of the turn and with an outstrip relative to the target equal to three radii of the turn (graph 4).

With (V_c) = 900 km/hour, (V_m) = 900 km/hour, and (β) = 30°, the diameter of the turn amounts to 22 km and the linear outstrip, 35 km.

The navigator-operator decides by eye the starting point of the maneuver.

When the maneuver is directed from the ground command point, the navigator-operator orientates himself by the line of flight of the target (B-A), by the impulses of the target (B) and fighter (C), and by the point (A), lying on the line of flight of the target (Graph 4).



Graph 4. Circle of possible errors when bringing out the intercepting fighter to the point of beginning of the maneuver.

Legend

B-A — Line of flight of target
R — Radius
C — Starting point of maneuver
S_{BWS} — Outstrip distance

On the basis of Graph 4 it can be stated that the farther the starting point of the maneuver from the line of flight of the target, the greater the possibility of errors in determining the exact position of the target.

In executing the interception from a vertical turn (half-turn), the distance from the beginning point of the maneuver to the line of the flight axis of the target is basically small (about 2 km), and the above errors have no practical meaning. The moment of the beginning of the maneuver (the giving of the order), when guiding the fighter from a vertical turn, is determined on the basis of one parameter, namely, the distance between two impulses of the target and the fighter; as a result, this assures much greater accuracy.

2) The overstrip distance with a target speed of up to 900 km/hour does not exceed the eye visibility of the target by the fighter pilot; this permits seeing the target and at the same time executing the maneuver (turn or half-turn) to get into position for the attack.

For example, with an instrument speed at time of starting the turn equal to 500 km/hour and at an altitude of 5,000 meters, the duration of the turn will be 24 seconds. Using the formula $S_w = V_c \cdot t_p$, it can be computed that the outstrip distance will be 6,000 meters.

As is seen from the above, under normal atmospheric conditions the target is within the eye visibility of the fighter pilot.

3) The approach of the fighters to the target after the beginning of the maneuver will take place after a short time interval.

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TACTICAL EMPLOYMENT OF VERTICAL MANEUVERS DURING INTERCEPTION

[Following is the translation of an article by Pulkownik Dyplomowany Pilot J. Czownicki in Wojskowy Przeglad Lotniczy (Military Aviation Review), Vol XIV, No 4, pages 25-27, Warsaw, April 1961.]

In an article by Captain Witek in this issue of Wojskowy Przeglad Lotniczy, there is a discussion of the method of intercepting targets at low altitude with the employmant of this method from the tactical side. As the title of Captain Witek's article suggests, this method is suitable for fighting low-lying targets. I agree with this, but would like to remark that the employment of this method could be wider.

The essence of the method consists in having a preponderance in altitude over the enemy and of using this preponderance for gaining in maneuverability and speed when the airplane is brought in to the position of departure for the attack. The extra altitude amounts, so to speak, to a reserve of speed for the airplane and at the same time permits a fuller exploitation of its maneuverability. This method is convenient to apply in cases when the enemy flies at a high speed and the fighter does not possess a clear superiority over him in this regard. This superiority can be increased by employing interception from a turn during which the fighter rapidly increases his speed to maximum; this makes the maneuver much more compact. Thus the essential advantage of intercepting from a turn is the possibility of attacking rapidly a target flying at high speed relative to which the fighter does not possess a clear superiority in speed. At the same time, the advantage of surprise can be used by sillfully bringing advantage of the overcast. In general, bombers cannot observe fighters attacking from the side of the sun.

Shortening the duration of bringing in the fighter is dependent on diminishing the parameters of the fighter relative to the target at the moment of starting the maneuver. With a shorter duration of the maneuver, the possibility of errors in bringing in the fighter are diminished, as is the likelihood that after having been brought in for the attack the fighter will have to overtake the enemy airplane.

The problem of course arises of gaining superiority in altitude over the target at the time of the brining-in maneuver. This is simple enough in cases when the fighter is intercepting from "patrol in the air," during which it is convenient to patrol

at great altitudes (the flight time of the fighter is teh increased). However, in cases of intercepting from "patrol on the airfield," there are basically two essential variants of the situation:

1) When there exists a certain amount of freedom in selecting the time of starting the fighters to the area of interception. This usually pertains to fighters acting in the second throw. It is then necessary in determining the time of the start to take into consideration the time needed to elevate the fighter to an altitude higher by 2,000-3,000 meters than that of the flight of the target;

2) When (in extreme conditions of interception) the fighters are ordered up immediately after discovering the target by radar. In this case interception with employment of the turning maneuver takes place when nearing the attack area. The commander of the unit executing the interception must then decide whether to come nearer to the area of attack or to intercept the target in the horizontal plane.

Interception from a turn is particularly applicable when fighting targets which are flying at a low altitude. This permits the convenient radar observation of the fighter by the control point, makes it easier for the fighter to observe the target (by visual means), and assures the fighter freer and easier maneuvering conditions than would have been the case had the fighter flown at low altitudes. Besides this, the time of flight of the fighter increases in these condition (the use of fuel is diminished).

Thus, the intercepting of air targets from a turn has in many cases basic advantages in comparison with intercepting in the horizontal plane. The possibility of its application clearly depends to a large degree on the training of the navigator operators, on the pilots, and on such factors as atmospheric conditions, time of day, and the flight altitude. (For example, at very great altitudes the employment of this method is of little worth). There is also required a minimal safety altitude for the execution of such a maneuver.

Considerations on employment of interception from a turn could become a point of departure for considerations on employment during interception of the vertical maneuver in a wider sense. We speak here of the employment of such forms of the vertical maneuver as the "fighting twist" and the "twist on the little hill."

The employment of these forms of the vertical maneuver connected with the elevated position is applicable first of all with regard to modern fighters with faster-than-sound speed, which possess a considerable superiority in speed over the target. Employing, for example, the "fighting twists," a faster-than-sound

fighter closing in on the target on an oppeeite course will come out on an attacking position very swiftly. The vertical maneuver during the ascent will permit one to close in with great speed, assuring at the same time the possibility of diminishing speed when the fighter comes out on the attacking position. In addi- the same naeuver of coming out on the attacking position in combination with the ascending twist is not as diffuse and long-lasting as is the case with the twist in the orizontal plane.

The faster-than-sound fighters can employ the maneuver in combination with ascent when attacking targets with less speed (inparticular, transport airplanes, certain types of sea airplanes, and older types of bombers). Moreover, depending on the situation, it may even be expedient in air battle to employ this method while attacking targets with equivalent speed, as in using the advantage of surpise, employing barrage fire, and so forth.

The employment of the vertical maneuver while intercepting targets is naturally putting definite demands on the com - manders of the units, navigators-operators, and the personnel flying the fighters. Mastery of this method does not present special difficulties, for it demands only the appropriate computations and training, and the cooperation of the navigators-operators with the pilots executing the interception.

AREA PHOTOGRAPHING BY TWO OR MORE PLANES

[Following is the translation of an article by Kapitan Pilot J. Rybicki in Wojskowy Przeglad Lotniczy (Military Aviation Review), Vol XIV, No 4, Warsaw, April 1961 pages 35-42.]

Simultaneous area photography from two or more planes permits, in a very short time, one to take pictures of a relatively large area. It requires, however, preparation of the crew to fly the required area in formation and the taking of all kinds of pictures (strip pictures, stereoscopic pictures, and area pictures).

There are known two methods of photographing an area from two or more planes: individual strip photographing, and individual area photographing composed of two or three strips.

Photographing with these methods gives satisfactory results only then when the crews have mastered maneuvers for taking their place in the formation and when the established conditions for the flight are maintained.

The first of the methods mentioned above is quite simple. It was widely applied in the years 1946-52 with piston planes and gave good results. This method is at present discontinued.

Photographing from two or more planes by taking individual strip pictures does not represent great difficulties. Well-trained crews can perform this kind of photography without special preliminary preparations, since the computations and technique do not differ from strip photographing by one crew.

This method of photography could be carried out from 300 to 1,200 meters of altitude with a camera of 21 cm focal length, or from 550 to 2,000 with a camera of 40 cm focal length.

As we know, the width of the terrain possible to include from such altitudes is small enough when working with one camera. However, when using two cameras, the included area is increased by a third. This is very important, particularly in cases when it is necessary to photograph in a single flight. It is necessary to remember that in many cases it is impossible to encompass the object in question with one camera. However, when using two cameras, there is a greater likelihood of snatching the given

object on one flight in a small number of photographs.

One of the most important problems in photographing areas from planes (two or more) is to determine and maintain the proper distance between the planes.

The distance between the lead plane and the other planes is computed from the following formula:

where

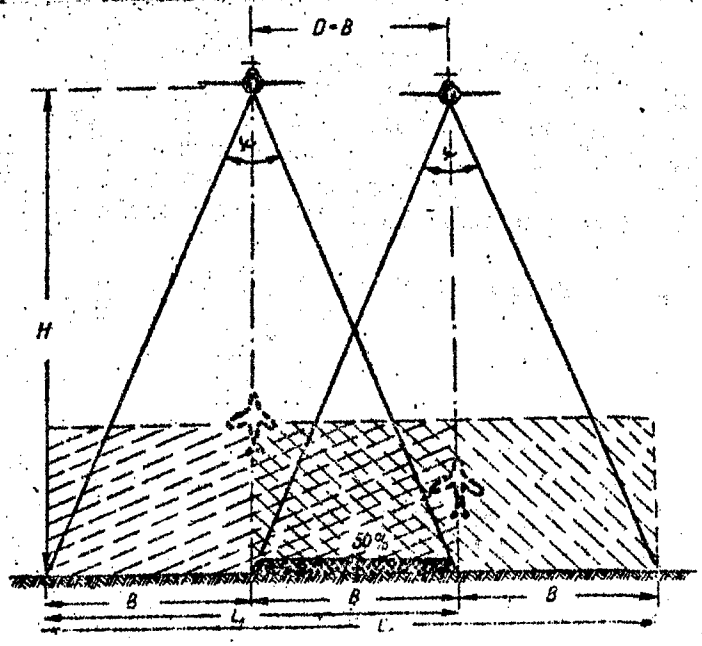
$$D = \frac{S_z \cdot b}{2},$$

S_z - scale of the photograph,

b = width of photograph area,

2 = a number defining 50% of the area covered.

Distances between 100 - 450 meters can be maintained without great difficulties when the crews are well trained in group flights. One of the best methods of maintaining the ability of the crews to keep the distance relative to each other is training in the cabins on the ground. Lines can also be drawn on the mobile part of the cabin shield corresponding to the magnitude of the leading plane on particular distances of the flight. It is necessary, however, to remember that the leading plane should be observed from a steady place (the head supported on the upper part of the ejection seat).



Graph 1. Area Photographing by two Planes

Area photography by two or more planes taking individual strip pictures takes place in the following way. Before reaching the target, all crews take up their positions in the formation, paying particular attention to the course, speed, and altitude of the flight. The camera is turned on at the order of the commander.

The second of the methods mentioned above for area photography consists of combining the method of area photographing in which one plane is equipped with a vertically installed camera, with the method mentioned above. In this case it is possible to photograph perfectly objects from somewhat higher altitudes. For example, with the help of a camera with a 21 cm focal length, photographs can be taken from an altitude of 1,200 meters; with the help of a camera with a focal length of 40 cm, photographs can be taken from an altitude of over 2,000 meters.

For the crews photographing a single area distances are computed somewhat differently than distances for crews photographing with two strips.

Distances for crews photographing an area individually is computed from the formula:

$$D = \text{tg}\alpha \cdot H,$$

where

(α) is the angle between the perpendicular and the extreme radius, and

(H) is the altitude.

An important part is the computation of the time of flight on a straight line during the time that the leading plane takes his place in the formation at the proper distance from the other planes. For this purpose it is necessary first of all to compute the time of turning by angle α with a steady incline (Graph 2). This computation is done on the basis of the formula:

$$t_{\text{turn by angle } \alpha} = \frac{0{,}64 \cdot V}{\text{tg}\,\beta} \cdot \frac{\alpha}{360},$$

where

0,64 = constant
V = speed
β = incline of the plane
α = angle of turn

After obtaining the time of the turn by the required angle, the course to be followed by the plane is computed in order to gain the necessary distance from the leading plane. This computation is done by the following formula:

$$S = \frac{D}{\sin \alpha},$$

where

D = distance

α = angle of turn

Subsequently, it is necessary to compute the time needed for passage of the course (S); this is done by dividing the result obtained in the preceeding formula by the speed (in m/sec):

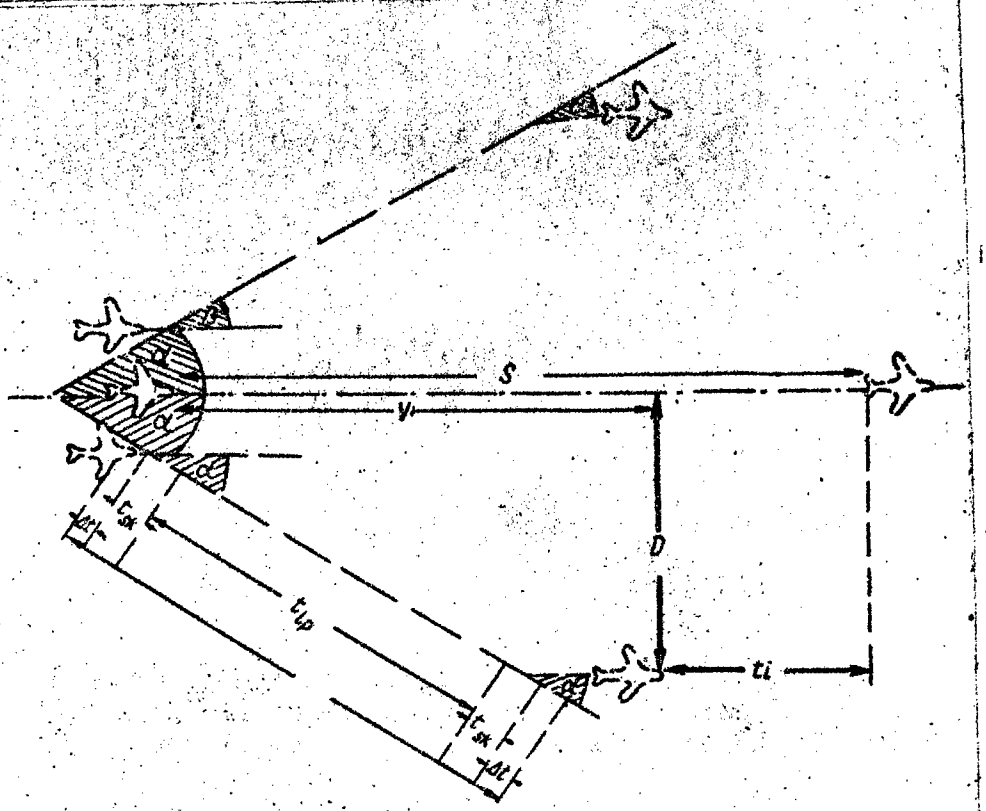
$$S_t = \frac{S}{\sin \alpha}$$

Having computed the time necessary to pass the distance (S_t), it is possible (after taking into consideration the time needed for making the turn and the time needed for bringing in the plane into the turn and bringing it out of the turn) to compute the time of flight on a straight course. The time of bringing in and bringing out the plane from the turn is indicated by Δ t); the time of flight on a straight course can then be computed from the formula:

$$t_{\text{straight course}} = \frac{D}{\sin \alpha} - \left[2\,\Delta t + \left(\frac{0.64}{\operatorname{tg} \beta} \cdot \frac{\alpha}{360}\right)\right],$$

or after simplification:

$$t_{\text{straight course}} = S_t - (2\,\Delta t + 2t \text{ turn by angle } \alpha).$$



Graph 2. Maneuver of three planes for the purpose of taking up the appropriate distances from the leading plane.

Graph 2. Legend

α — Angle of turn
Δt — Time of bringing in and out the plane from turn
t_{sk} — Time of turn by angle α
t_{lp} — Time of flying on straight course after making outward turn
ti — Time of turning on the camera
S — Scale of the picture
V — Speed

After obtaining the time of flight on a straight course, it is necessary to compute the time at which the pilot of the follower-plane should turn on the camera, bringing the plane at the same time on the working course.

The time at which the camera is to be turned on is computed from the formula:

$$t_{\text{of turning on}} = St - Wt,$$

or:

$$t_{\text{of turning on}} = \left(\frac{D}{\sin \alpha} - \frac{D}{\operatorname{tg} \alpha} \right) : V,$$

where:

S = passage time of the follower-plane

W = passage time with provision for safe distance

The next order of business is the computation of the area of the encompassed terrain. This area is directly proportional to the altitude and the angle between the perpendicular and the extreme radius (Graph 3).

The area of the terrain encompassed by a single crew is computed from the formulas:

$$L_1 = 2\,B,$$

$$B = \operatorname{tg} \Psi \cdot H$$

$$L_1 = 2\,(\operatorname{tg} \Psi \cdot H).$$

For two crews, the area of the encompassed terrain is increased by (1-B) ($\frac{1}{2}$ the width of the terrain encompassed by one crew); for three crews it is increased by (2-B); for four, by (3-B), and so forth. In computing the width of the area encompassed by two planes photographing an area composed of six

strips (graph 3), it is necessary to remember that the overlap between strips should amount to 50%. This width is computed from the formula:

$$L_2 = 3 \ (\text{tg } \Psi \cdot H).$$

The width of the area encompassed by three planes is computed from the formula:

$$L_3 = 4 \ (\text{tg } \Psi \cdot H).$$

Using these formuals, we compute the width of the area encompassed by three planes assuming, that H 3,000, and $\Psi 46^0$:

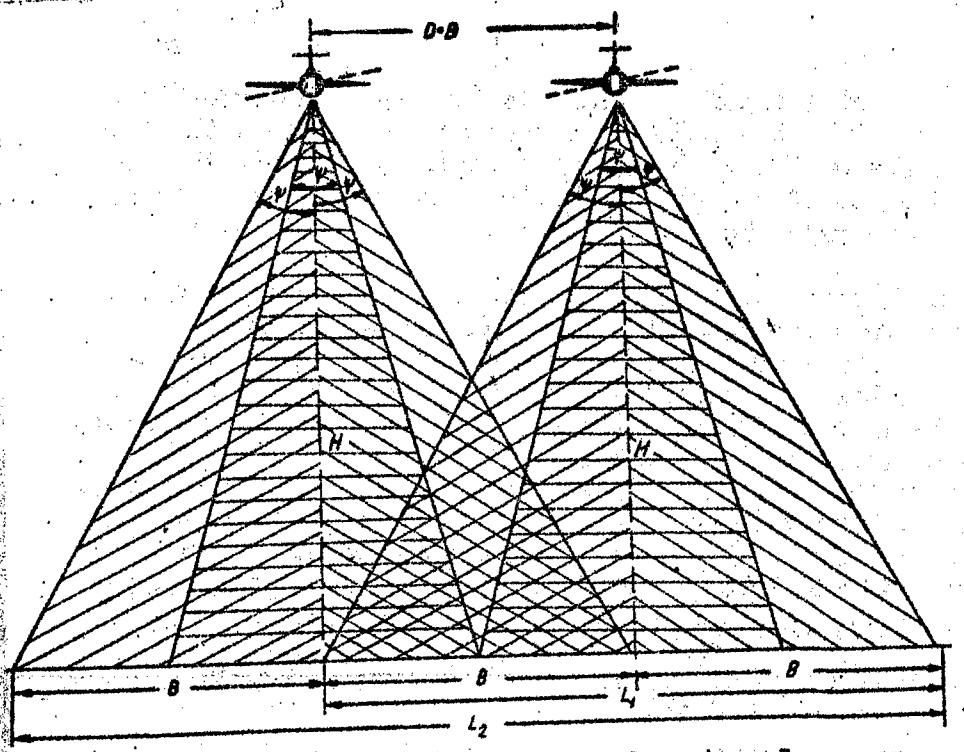
$$L_3 = 4 \ (\text{tg } 46^\circ \cdot 3{,}000 \text{ meters})$$
$$= 4 \ (1.01 \cdot 3{,}000) = 4 \cdot 3030 = 12120 \text{ m.}$$

As is seen from the above computations, three crews of fighters during one flight can photograph from an altitude of 3,000 meters a terrain with the width of 12,120 meters; this is a very great achievement, with but a small investment of time.

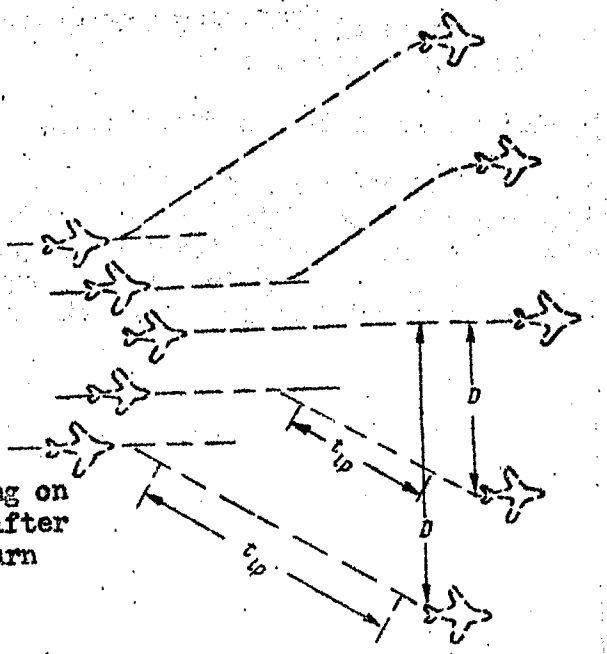
Area photography from two or more planes requires much training in individual area-photographing, as well as training in accomplishing the maneuver of taking up the proper distance in the formation.

The method of area photographing by two to three crews is as follows:

After going out on the photographing course in compact formation and establishing the necessary conditions of the flight, the crews, on the order of the commander, make outward turns at an angle of 15° or 30° (dependent on the altitude) from the photographing course, with an incline of 30°. After making the turn they fly on a straight line, after which they make an inward turn at the same angles and on the same incline. In this way the required distance is maintained. After receiving from



Graph 3. Diagram of photographing from two planes an area composed of six strips.



t_{1p} =Time of flying on straight course after making outward turn

Graph 4. Taking up the appropriate distances before photographing.

the leading pilot a report of readiness to start photographing, the commander gives the command to turn on the cameras. The leading pilot turns on the camera in time (t_1), maintaining the required conditions of the flight. After turning on the cameras, all crews photograph the area individually in two or three strips.

Area photography by four or five planes does not practically differ from the method given above for two or three planes. The only difference is that the spreading-out of the crews may take place either individually or by pairs (graphs 4 and 5), and that the time of flight for the particular crews will differ, depending on their place in the formation.

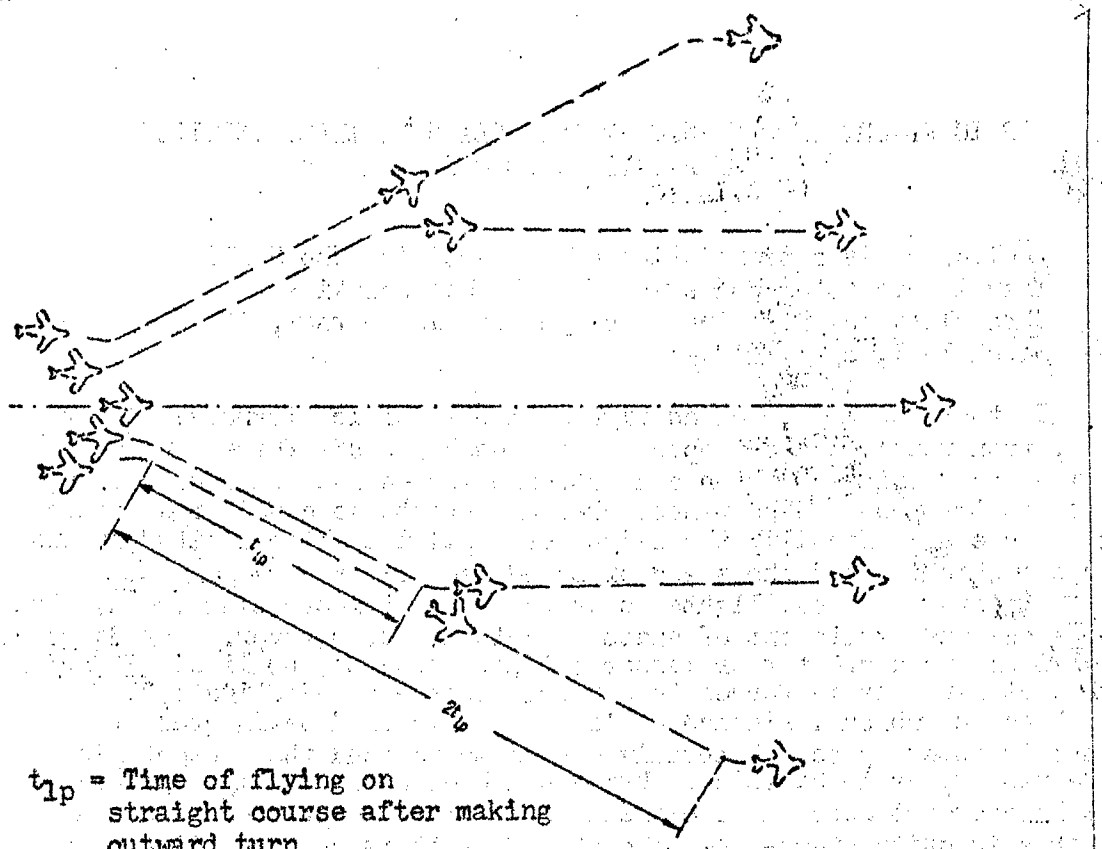
During the time of the spreading-out operation (maneuver), the follower-plane keeps on the straight course twice as long as the lead plane, after the former has made the outward turn. For example, if the lead plane of the pair flies for ($t_{straight\ course}$ = 10 sec), then the follow-plane flies $t_{straight\ course}$ = 20 sec), and then comes out on the course for photographing (graph 5).

The chief conditions for carrying out the task using this method are:

1) maintenance of the necessary conditions of flight (speed, altitude, incline);

2) observance of the computed time.

If these conditions are fulfilled, the task will be successfully accomplished. It is necessary to mention that the crews who have mastered area photography in pairs and in files may undertake area photography in larger groups. Such photography does not basically differ from that discussed.



t_{1p} = Time of flying on straight course after making outward turn

Graph 5. Spreading out of the planes by pairs for the purpose of taking up the appropriate distances before photographing.

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COSMIC FLIGHT EXPERIMENTS AT THE POLISH MILITARY INSTITUTE OF AVIATION MEDICINE.

/Following is a translation of the article "Who Shall Travel Into Outer Space? by Tadeusz Malinowski in Skrzydlata Polska (Winged Poland), No 12, Warsaw, 19 March 1961, pp 12-13./

Is there such a thing as high altitude cosmic sickness? If it exists, then what are its symptoms and consequences? These, and other questions concerning aviation and astronautics, arise quite naturally, and assume tremendous importance, when one starts to consider a manned flight, more specifically, the flight of a pilot at high altitudes, and at speeds which exceed the speed of sound many times.

The era of space flights is approaching at increasing speed. The strangeness and excitement of space flights hides, however, many dangers. All of them, to a greater or lesser extent, threaten our life. In order to protect man, one is forced to perform countless investigations of many phenomena which influence man's life; this is done in order to put a man into outer space. Naturally, one aims to send the man out, in such a manner, as to be able to bring him back again safely. Generations have dreamt about interplanetary travel. The progress made in this area is quite staggering, and therefore it is quite difficult to state with any certainty whether the flight towards unknown planets shall begin in a year or two, or perhaps in a few months. Every day brings news of progress in aeronautical technology. True, those are not yet manned interplanetary travels, however they impress us by their exactness and boldness of planning.

However, let us come back to altitude sickness. Oxygen deficiency at high altitudes is the cause of a number of symptoms which are called generally altitude sickness. These symptoms, which are various disruptions of the human organism, have a detrimental effect on the human nervous system. When there is no oxygen, i.e. in the case of oxygen-starvation, one may observe temporary consequences of excessive excitation of the central nervous system, which are characterized by certain specific psychic phenomena, as for example, excessive mobility, excitement, alertness, and a marked increase of interest in the environment. However, as the altitude increases, after the excited state, there come the symptoms of a retardation in the processes of the central nervous system. One begins to feel sleepy, and to doze; one becomes tired and passive, headaches begin, and one becomes insensitive and slow, the handwriting changes, the hands begin to shake, there is a loss of coordination, mental processes are slowed down, and one begins to feel indifferent towards immiment danger.

For a pilot, the most dangerous phenomenon of altitude sickness, is the loss of consciousness. This comes over him suddenly and completely unexpectedly. Then, it is to be expected, that the plane, when it is no longer controlled, shall begin to lose altitude rapidly and may find itself in such a position that its flight may no longer be stabilized. If the pilot in the falling plane regains consciousness in the lower atmospheric layer, let us say at about 6000 meters, he still has a chance to avoid disaster. He then regains control of the plane. His awakened consciousness of action and returning alertness, are concentrated on his trying to save the plane, and thus himself. Otherwise, when the pilot regains consciousness at a low altitude, such a flight ends in a disaster. Up to an altitude of 4000 meters, man is able to work without breathing additional oxygen, indefinitely, and work, while in flight, with moderate physical exertion. The insensitiveness of the organism to the varying amount of oxygen, depends upon many factors. It develops in many ways. The most important factors are the strength of the human organism, and the intensity of work at a given height. A simple conclusion is reached here, namely: from 4000-5000 meters, the flyer has to have an additional source of oxygen. This process is called "breathing additional oxygen", which comes from an oxygen bottle, by means of an oxygen mask. By equipping the pilot with additional oxygen, a pressurized cabin and a special high altitude suit, he can perform physical tasks and mental processes at high altitudes.

It is not sufficient to test the strength of the human organism during flights up to 20,000 meters. Here one is concerned with high altitudes of the order of tens or hundreds kilometers. Here, we deal in extremely fast flights, where one could experience tremendous accelerations and weightlessness. Under these conditions one may experience many things, not excluding altitude sickness; these are problems which are considered in great detail by aviation medicine.

Before man can orbit about earth, or travel to another planet, he will have to undergo a program of preparations worked out in great detail, which shall ensure his safe return.

Who shall fly into outer space? Many people who are interested in aviation and astronautics, ask themselves this question. It is clear that a candidate for a cosmonaut shall be a man who can meet the most stringent health and physical requirements, a man who shall be an expert supersonic plane pilot, i.e. a man who has had extensive flying experience, a man resistant to fatigue, capable of performing long and tedious work under unfavorable conditions (for example in small uncomfortable chamber; in a capsule), a man able to overcome and to react correctly to unforeseen phenomena while in interplanetary flight, man capable to do without sleep, and one endowed with an excellent memory (although he has a tape recorder).

After a suitable choice of the candidate for a cosmonaut, there comes the period of long and hard self-improvement course both theoretical and practical. In his theoretical courses, the future astronaut learns such disciplines as: astronomy, mathematics,

biology, the construction of rockets and interplanetary ships, the theory of cosmic flight, cosmic radionavigation, etc. The practical course is so designed to introduce the candidate to flights at high altitudes and at tremendous speeds. These are the tests and the practical exercises. The candidates are subjected to various experiments in a low pressure cabin, are carried on rocket trolleys, which develop great speeds, are shot into the air by means of ejection seats, are lowered in containers by means of parachutes and are left on their own at sea for at least two days. They witness the flights of rockets with capsules, they observe from jet planes and intercepting planes, the method, control and technique of intercepting the capsule in which they shall find themselves in the near future.

Thus the expedition into the outer space is a very complicated affair in which in addition to the pilot, a large staff of scientists, doctors, engineers, technicians, specialists from many areas and the air force are involved.

Are we accomplishing anything in this area here? Of course, but not to such an extent as we have described above. In our Wojskowy Instytut Medycyny Lotniczej (The Military Institute of Aviation Medicine), Polish pilots have been undergoing tests and preparations, for what one may term to be a mock-up of what awaits a cosmonaut. Every jet pilot, every so often, is examined by aviation medicine. This is a science which is indispensable to a modern air force. The pilot undergoes a rigorous and thorough medical examination. Amongst other things, the pilot is tested under the conditions of a very rapid flight at high altitudes. He is observed under conditions of oxygen deficiency, while there are changes in his nervous system, and other symptoms. These are sometimes simple but very important examinations. This is being done in order that a healthy jet pilot remain healthy, and that he should have the best morale during flight under difficult and unforeseen conditions. Some of these tests we show our readers in the photographs taken by the Wojskowa Agencja Fotograficzna (the Military Photographic Branch).

Hence we see, that our distinguished specialists, the doctors of the Military Institute of Aviation Medicine, to some extent prepare our pilots for the eventual flight into outer space.

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ECONOMIC-MILITARY POTENTIAL

[Following is the translation of an article by Polkownik Doktor Zygmunt Beczkiewicz in Wojsko Ludowe (People's Army), Warsaw, April 1961, pages 43-48.]

The genesis and reasons for undertaking the study of economic-military potential, its role and meaning.

Interest in economic-military potential dates from the beginning of the nineteenth century and is closely tied to the rise and development of large national armies. However, the development of large armies and the rapid increase in their technical equipment began to exhaust the apparent national reserves; the state's economic obligations along with the maintenance of armed forces and carrying on war began to outgrow its normal possibilities. This began to stimulate an increasingly greater interest in military economic possibilities during peace and war -- not only one's own possibilities but also the enemy's.

Both past world wars were particularly characteristic in this respect. They also contributed greatly to the development of studies of state economic possibilities for military purposes and the economically safe-guarded conduct of war. Since then, these studies have been conducted on an ever-increasing scale in all of the larger states possessing modern military forces.

Presenting a picture of the condition of strengths and possibilities, studies of economic-military potential have become the basis for all the most important military decisions. They have great significance in such questions as the division of national income for peaceful and defense purposes, establishing the investment trend in defense industry, revealing and overcoming the so-called military production "bottlenecks," creating a desirable structure of material supplies, reserves, etc.

In the event of direct threat, the data concerning economic-military potential constitutes the basis for mobilization and converting the economy to war, and in time of war -- conducting it.

A knowledge of economic-military potential is also a basis for action of central military organizations and commands of a higher level, namely, strategic planning and development of military forces; decisions concerning the defense of one's economic communications, and military centers; the destruction of enemy centers. This knowledge is an indispensable element for establishing or predicting the character, extent, term, and duration of strategic operations and activities in general; in a word: for proper leadership on a higher level. Hence the important and constantly growing role of study of the economic-military potential in contemporary military science.

The newest military literature of the Radziecki Alliance places

great emphasis on the meaning of the study of one's own and the adversary's economic possibilities. In the book Radziecki Military Science by a group of authors (Candidate of Military Science Major General M. W. Smirnow, Colonel I. S. Baz, Colonel S. N. Kozlow, Colonel A. Sidorow), released about the middle of 1960, it is asserted that: "The study and comparison of the economic possibilities not only of one's own country but also the adversary's constitutes a scientific basis, gives scientific value to our theory of preparation and waging armed combat, precludes the danger of detachment from realistic material possibilities and being frustrated in a maze of phantasy and adventures in armed combat".

([Note] See: "The Object and Character of Radziecki Military Science," Wojsko Ludowe, No 1/1961, page 7.)

The concept "potential" in economic and military sciences.

The concept "potential" is used in many sciences. Depending on the character and type of problem, the concept "potential" in the economic and military sciences means:

1) the possibility of accomplishing a particular undertaking (economic, military) in the materials sphere resulting from given forces;

2) the existing relatively attainable material strength (economic, military) comprehended and evaluated from the standpoint of its exploitation for some undertakening;

3) the source of possible power for the realization of some specified undertaking (economic, military).

As we see, the element of possibility plays a dominating role in potential. Therefore, from this point of view one conducts analysis through examining potential. In economic and military sciences this constitutes the fundamental basis of the study of all potentials.

The possibilities constituting the object of interest in economic and military science belong, generally speaking, to the materials sphere. From the standpoint of type, they can be very diverse, e.g., manufacturing, production, unloading, transfer, etc. With reference directly to the military, they will relate to ordinance, transport, maneuver, etc.

The various kinds of possibilities correspond to diverse subjects of such possibilities, e.g., the factory, railroad, air-force, man, beast, etc. In the military, on the other hand, to the soldier, armament, equipment. These studies may likewise concern various levels and encompass a smaller or greater range, e.g., factory, combine, branch, industry as a whole, national economy, zone, country, state, block of states, a military unit of various levels, kind of troops, front, the state's armed forces as a whole, the strength of a block of states, etc.

In economic and military science it has been accepted that the concept "potential" is utilized only in general considerations and pertains in principle only to self-sustaining areas or regions arising in considerations on the central level as well as to the kinds of possibilities appearing at this level. This arises from the fact that at the higher level

the question of this or other possibilities constitutes a problem of a different kind than that on a basic level: it is considered in a different category and acquires a different meaning.

In the national economy, the concept "potential" refers to such independent operations, areas, or branches of the economy as industry, agriculture, transport, etc., as well as -- or even chiefly -- to the national economy of a country, region, or entire block of states. However, with reference to the military, the concept "potential" refers to independent kinds of forces such as land, naval, and air forces, rocket troops, and eventually certain other kinds; above all to the entire armed forces.

With reference to smaller units, equally in economic as well as military science, the common term "possibility" is used in principle.

The concept "potential" is therefore used by economic and military science in general considerations. In economics, such considerations are called macro-economic; those pertaining to enterprise -- micro-economic.

In general, in macro-economic considerations we are concerned with a subject which is distinctly collective, composed of many heterogeneous, relatively autonomous units and entire groups. For example, the national industry is composed of thousands of the most diverse enterprises of various specialties and spheres, organizationally and functionally independent (separate economic entities) tied, however, to each other with a close, mutual, productive dependence resulting from the social division of labor. From this standpoint, industry is closely dependent on the remaining branches and areas of the national economy, such as agriculture, transport, and trade. The same can be said of agriculture, transport, and every other branch and area of the national economy. However, we examine the economy in its entirety, the degree of aggregation is obviously still greater. Besides this, we must consider the increasingly greater number of alliances, dependences, and other conditions.

The higher the level of the analysis of economic possibilities, the greater is the aggregation of the object studied and its associations and conditions, and the more diverse are such associations and conditions. In general, alliances, dependences, and conditions enter into consideration; there frequently have a fundamental significance. When these are considered at lower levels, they appear (or do not appear) to such extent that they generally might not be considered. These are not only economic-technical problems (where, besides a problem of production strength, there arise such questions as the balance of raw materials, labor forces, industrial services, transport, the supply of energy, etc.), but also structural, organizational, and political questions.

In view of the above-described studies of the potential of the material sphere, if one desires to get a truly adequate picture one cannot limit himself to the usual comparison of the balance of force of strength and means. Study must entail or adequately take into consideration other factors which have a real influence on a given potential. The establishment of these factors and the description of their role -- this is one of the basic problems of methodological theoreis of potential.

General methodological basis for the study of potential.

In studying potential in general and economic and military potential in particular, the principle concern is the establishment of a specific possibility. We emphasize a proper acquaintance and an adequate consideration of fact, because in the study of potential the chief research-object is possibility. It has basic methodological meaning for the unity of considerations of potential. This defines a recognizable goal of study as well as the object of study.

Economic forces and means create economic possibilities, while military forces and means create military possibilities. The more perfect are the forces and means and the more abundant their extent and sources, the greater the possibility for human action they create under given circumstances. Hence, economic forces and means, as well as their sources, constitute economic potential; military forces and means, as well as their sources, constitute military potential; economic-military forces and means, as well as their sources, ... Speaking briefly about potentials of a material nature, they constitute (that is, create) material forces and means, as well as their sources.

In state of the world's current material activity, equipment and means are highly specialized. They are adapted to closely defined activites and prescribed work. This specialization predetermines their use and, consequently, their activity. Hence, universal possibility is non-existent. In the sphere of material activities, a person's possibilities are closely predetermined by material forces and means.

Forces and means which have great usefulness for one kind of activity (most frequently for that for which they were especially designed) can, as a result of their specialty, prove of little use or, in general, useless in another. For example, the forces and means for personal transport are of little use for the transport of merchandise, industrial or textile products, and metal-working tools; the reverse is also true. In the metallurgical industry, specialization is so far advanced even in a single field that machine tools and facilities designed for a given kind of operation are adaptable only to a small degree or are generally useless. Even a small change in the production process required technological change or selection.

In the face of the diverse usefulness of given forces and means, as well as their sources for accomplishing different tasks, it is not possible to establish an equal value between forces, means, and their sources or potential. Forces, means, and their sources have only as much potential as the possibility of the desired task which they do, the possibility of realizing a given task. The object of the study of potential is not forces, means, and their sources as such, but the possibility of a defined material activity arising from them, the possibility of realizing a specific task. What interests us is their usefulness for a given activity.

Possibility, as a capacity for performing a defined task, therefore depends not only on forces and means which are at hand but also on the task as such; its nature, extent, and character. Stating the matter generally, the full realization of given forces and means, provided there are

no other hindrances, is possible only through their utilization in a manner consistent with their purpose and only in complete harmony with the kind and character of the forces and means.

All human activity occurs in defined conditions: natural, economic, social, political, and, in time of war, military. They can facilitate a given human activity or make it difficult or generally impossible, deprive it of purpose, or render it indispensable without regard to the difficulties, labor, amount of work, forces, and means involved in a given activity.

Economic potential, understood as a defined economic possibility, is, as we see, a defined result of forces and means which create the possibility of a given activity, as well as the task and its conditions of realization. We can therefore say that studies of potential, taken from the economic and military standpoint, are the specific treatment of available forces and means relative to those which could be attained, considering them from the viewpoint of their inherent possibilities, for realizing a task under given conditions.

Generally speaking, economic possibility as well as all material possibilities (such as economic-military, military) are conditioned by existing or potential forces and means (quantity, quality, supply, and their sources, etc.), the task (extent, kind, character), as well as the conditions (natural, economic, social, moral, political, military) of its realization. Differentiation and a proper consideration of these conditions possess a real significance in considerations concerning potential.

Numerous differences occur between potential as a force creating the possibility of action, and potential as the possibility of using force and means, as well as between the task and the conditions of its realization. They emerge particularly clearly in studies of economic-military and military potential in general.

With the exception of specialized defense industry, the material forces and means are adapted to peaceful conditions from which the military tasks and conditions basically diverge. The greater the divergence, the lesser will be the effectiveness of the benefit for war purposes from the state's material forces and means.

A suitable recognition of possibility being the object of interest therefore demands definite studies not only of the forces and means creating it but also the tasks and conditions for realizing the tasks, comprehending the possibilities inherent in given forces as being closely related to the tasks and conditions of their realization. In addition, it requires taking into consideration all of the potential factors, according to their influence on the possibility under study.

Factors defining the state's (block of) economic-military potential and its effectiveness.

Accepting that by the economic-military potential of a block of states we mean the whole of its economic-military possibility, together with accepted methodological assumptions, the chief factors defining the effectiveness of this possibility must be acknowledged as:

1) the existing and possible material forces and means as well as their supply, that is, the state of the national economy as well as its resources of raw materials, energy, and manpower;

2) the degree of adaptability of available forces and means as well as those potentially available for the realization of economic military tasks;

3) the adaptability of the national economy to war conditions and its resistance to disturbances and fortunes of war.

Let us examine these factors somewhat closer.

The greater and more perfect the forces and means at the disposal of the national economy, the greater in general is the defense capacity. This is obviously so, on the condition that the economy is self-sufficient in its ability to satisfy war needs or the possibility of providing an adequate supply for its deficit. On the other hand, if a deficit occurs in an essential area (e.g., steel) it can become a factor limiting the general ability of satisfying war needs.

As a rule, economic forces and means are created and developed according to the needs and conditions of the peaceful development of a given area, state, block of states, continent, etc. The conditions and tasks of peacetime determine the nature of the production profile as well as its location. The producing apparatus is adapted to this, as well as to the proportions between individual activites and branches of the national economy. The possibility of exploiting the forces and means of the national economy to safeguard the needs and demands of war depends on the degree of harmony in the existing state with the needs, demands, and conditions of a given war.

The degree of harmony or discord may be (and is, as a rule) very different in different economic activities and different national economies taken as a whole. In certain production activities, e.g., agriculture, the profile of peace or wartime production does not vary excessively. On the other hand, the tasks presented by war in, e.g., the metallurgical industry are usually so different from peacetime demands that utilizing it for war production demands the carrying out of far-reaching changes. Adapting it to the new technological profile resulting from war needs takes months and even years. However, in war production a number of forces and means are generally useless. A change in the production profile entails the necessity of a change in proportions. War needs demand the strong development of the productive means for waging war (arms, war equipment). Here are attained at the cost of limiting non-defense production. Consequently, the capacity to convert industrial production and transport to satisfy military demands, not only from the standpoint of extent but duration as well, possesses a fundamental influence on the effective use of industrial potential.

The ability of adapting to war conditions and resistance to war disturbances possesses an equally essential influence on the possibility of exploiting economic forces and means for satisfying material war needs.

Contemporary war changes the whole complex of conditions in the functioning of the entire national economy. Today's thermo-nuclear means, able to reach every point of the globe and destroy every industry, immensely increase the possibility of destructive activity throughout the length and

breadth of the world. In this situation, the resistance of the national economy to nuclear attacks possesses a primary significance. From this viewpoint, countries with smaller concentrations of industry and population have a much better natural possibility of preserving their industry and benefiting therefrom, than countries characterized by large concentrations of forces and means.

A real influence on the effective use of the national potential for defense purposes is possessed by the social-economic structure. In a country in which the socio-economic organization is based on social ownership of the means of production and national economic planning, defense and peace-time needs can be resolved systematically in the course of planning the economy's development. Socialist states having control over the economy and an adequate, specialized economic organization in comparison with capitalist states have much greater conversion possibilities. As "Radziecka" practice during the Second World War demonstrates, they can accomplish it much faster, more fully and effectively than capitalist states possessing much greater possibilities for accomplishing conversion and in which the economy finds itself basically beyond the state's control. Wishing to engineer more effectively and radically the economy's course, they must take recourse in exceptional steps answering exceptional situations. From the standpoint of a socially planned economic system, a socialist state also possesses a much greater possibility of exploiting the national economy and safeguarding military needs in the course of a war than do capitalist states.

With these, among others, can be explained the fact that in the course of the last war the Radziecki Alliance, in comparison with its forces and means, managed to obtain the most armament and equipment. As the American Professor K. Knorr said in his work States' War Potential, in the years 1942-44 for every one thousand tons of steel produced, the Radziecki Alliance produced nearly six times more armored weapons, nearly thirteen times more artilery, over thirty-eight times more mortars, nearly twice as many machine guns and automatic pistols, and over three times as many planes.

The degree of the effective benefit from available forces and means can be, as we see, very different. In the Radziecki Alliance, thanks to the entire group of factors resulting primarily from a planned economy, the coefficient of effectiveness was many times higher than in the USA and all of the remaining capitalistic countries taking part in the last world war. This clearly proves that analyses of economic military potential cannot be restricted exclusively to a balance of forces, means, and needs, as is done in nearly all bureaucratic military-economic literature. If we wish to obtain a reasonably objective picture of a problem being examined, the analysis of potential must always be carried on in the context of a three-cornered dependence, one side of which represents forces and means; the second, tasks; and the third, conditions.

The problem of the measurement of potential.

Measurement is one of the chief questions linked with potential. It is, at the same time, one of the most difficult. Economic potential, as we have already pointed out, is comprised of many relatively independent activities, areas, and organizations. It is of an aggregate nature. The greater the aggregate, the more its comprising elements appear and the more it contains mutual ties, dependences, conditions, etc. The more difficult is a proper separation of individual ties, the more difficult it is to grasp the correctness of the quantitative side and to accomplish its suitable measurement. In many instances, this is generally an impossibility. One must then be satisfied with a general qualitative analysis for furnishing the bases for estimating the extent of its value. And even this becomes more difficult as potential is increasingly concentrated as more elements, ties, dependences, etc., emerge.

In a potential as strongly aggregated as the economic-military potential of a state (or block of states), the quantity of separate single elements reaches an order of tens of thousands and the mutual dependences between them multiply in proportion to their number. Therefore, grasping all these elements and their dependences at the central level is -- at least by current means -- very difficult and often generally impossible.

Electronic calculators can in time contribute an invaluable service here. But even with their fullest possible utilization there does not appear to be a complete possibility because of the number of other kinds of difficulties. We are dealing here with a series of factors which cannot be fully measured. Moreover, the strength of potential is not, as we have emphasized, a common sum of individual strengths. In an analysis on a central level, one is not concerned with specific given units but in finding the best possible artificial indicator. This is done even at the cost of accuracy. The practical benefits flowing therefrom are, however, greater than the eventual losses resulting from inaccuracy. The ideal would be if it were possible to express the quantitative and qualitative side of a potential in some kind of single universal indicator.

During the Second World War, the Germans adopted steel as such an index to simplify the planning of war production and to have a single measure for comparing it and their economic-military potential with their adversaries' production and potential. As later experience and scientific analysis showed, this indicator was far from perfect; its erroneous use by the Germans depended mainly on the full negation of the social side of the problem and increased the degree of this indicator's inaccuracy still more.

In view of the great quantity of elements and associations in collective potentials and the need for the most synthesized grasp and expression thereof (up to a single index, inclusively), there exists the possibility (and in many cases also the desirability) of applying various degrees of generalizations and various indices. Usually one selects those which have a real meaning for a given sphere.

The economic-military armament industrial potential, in a strict sense (production of tanks, artilery, etc.) is limited by the production of steel. Consequently, for this branch steel can be the universal index; however, it cannot be a general index for the entire national economy.

For example, the main index for evaluating the aircraft industry potential was (and is) the production of aluminum, while in the production of explosives and ammunition, which in both world wars had a capital significance, steel (that is, as a raw material) generally does not play a part.

In the day of nuclear rocket armament, considering other armaments of massive power such as biological and chemical weapons, the position of steel as the main index of the economic power undoubtedly has been devalued even more. To express the nuclear power of a given state, one can, for example, benefit from the index of the production of radioactive materials. But such an index does not tell us very much about the rocket potential or aircraft upon which depends the possibility of using nuclear arms, or their quality. The production index of radioactive materials likewise says nothing about the production potential in the area of conventional arms.

Thus, we cannot state absolutely what kind or how many indices it is proper to utilize. This question should be resolved individually, depending on the situation and the need. It is necessary to remember, as pointed out above, that the higher the degree of generalization, the less indices there are; the lesser also is the accuracy, the more one-sided the picture obtained. All of these varieties of indices possess only relative value and are, as we see, historically variable.

The transformation of the economic possibilities of a nation into actual military or economic-military force depends on many factors and conditions, not only the natural, social, organizational, and political, but also knowledge and the role of man. The true role is played by the extent of the preparatory undertakings accomplished in time. They possessed great significance during the course of the last world war; currently, because of the universalization of nuclear arms and rockets, their role has grown immeasurably.

In this situation, techno-economic indices characterizing economic potential are by themselves not yet sufficiently authoritative for drawing conclusions about the factual disposition of strength. An adequate picture of the disposition of forces demands a suitable consideration of many indices, as well as all of those factors and circumstances which have an essential influence on the effective use and exploitation of given forces and means.

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YUGOSLAVIA

ABC DEFENSE OF THE YUGOSLAV NAVY

[Following is the translation of an article by Kapetan Bojnog Broda (Navy Captain) Stevan Zutic in Vojno Delo (Military Affairs) Vol XII, No 9, Belgrade, September 1960, pages 502-509].

The invention of atomic weapons and the intensive work on biological and chemical warfare which may be used in a possible future war in sea combat as well brings the problem of ABC (atomic-biological-chemical) defense of navy units and establishments into the foreground.

Although the general purpose of the ABC defense is the same for all branches of the armed forces (i.e. the application of appropriate measures for the protection and support of units and establishments under ABC attack from the enemy), the specific structure and tasks of the navy, the specific character of a battlefield at sea and its influence on the possibility add effect of ABC attacks, the factors in ABC defense of the navy as a whole and its individual branches must necessarily show specific differences.

There are navy units and establishments for combat operations on land, sea, and rivers. Regardless of the differences of the organization and structure within these sections, each of them includes certain factors which determine the character of the ABC defense.

The ABC defense of the coastal navy units does not differ essentially from the ABC defense of other military units. The fact that the units for coast defense are usually stationary in connection with the object which they are to defend limits the maneuverability of these forces for avoiding an ABC attack or its effects, but on the other hand, this makes it possible to carry out protective technical measures (shelters for personnel and equipment; underground storage rooms and repair facilities; casemates for coast artillery batteries, etc.) in peacetime.

The most probable and profitable targets for ABC weapons will doubtlessly be naval bases, not only because a considerable part of the coast defense units and possibly some anchored ships are concentrated there, but also because of the overall importance of these bases for the combat ability of the fleet (supply, equipment, repair, and protection of the ships) and the navy as a whole. The elements of naval bases are concentrated in a relatively small area (as dictated by the defense in classical warfare in the pre-atomic period), and the distribution of these elements is known in peacetime; these facts aide the enemy in planning, preparing, and

carrying out ABC attacks. This fact has compelled all maritime countries to consider the problem of the defense of their naval bases against possible attack. The efforts for the defense of naval bases are developing in two directions:

Construction of underground shelters for ships, repair facilities, storage rooms, elements of coastal defense, etc., and

Dispersion of the elements of naval bases over a large area.

The underground shelters afford good protection, but require a prolonged construction period and great financial expenditures. Also, they could be constructed only on steep shores, and they are not applicable in naval bases on level shores. Dispersion requires much less time and expenditure for construction work, but the ABC defense is not as effective, and the defense in classical warfare is even more difficult than with bases of the classical type. Even so, this possibility, although less effective than the former, offers far better chances of surviving an atomic attack than the naval bases of the classical type.

The problem for the ABC protection of the landing forces of the navy during their stay or action ashore is the same as for army units; during transport, before reaching shore, their ABC defense is essentially the same as the ABC defense of the crews. Therefore, this article stresses the ABC defense of the naval forces afloat, which is essentially different from the ABC defenses in other branches of the armed forces.

The manner in which ABC warfare is applied and its effect depend to a considerable degree on the kind of target and its environment. Type, size, vulnerability and other characteristics of the target, as well as the structure, geological composition and vegetation of the terrain in the target area have considerable influence on the selection of the ABC weapons and the manner of their use. On land, these elements are variable, and for each concrete case they must be gathered and evaluated anew. For ABC action against naval targets, this task is considerably easier and simpler. The target in question is always the same: a vessel, forming a dot-like movable target with a large maneuvering area. The differences in the ability of different types of ships to withstand the effect of atomic weapons are more or less known quantities. The influence of the sea is always the same, with the exception of underwater atomic explosions in shallow sea, when the depth of the sea and the geological composition of the sea bottom modify their effect in a specific way.

As an illustration of the influence of "ambience" on the effect of atomic weapons against ships, we shall discuss the two most probable ways of using these weapons which afford optimum

results against targets on the sea; these are explosions high in the air, or shallow underwater explosions.

In case of a shallow underwater explosion (10-30 m deep), in addition to the air shock and heat and radioactive radiation, ships are exposed to the danger of the underwater detonation blow and the blow from the waves created in such an explosion, and to contaminated water particles or a contaminated sea. Of all these effects, the most dangerous for ships is the underwater blow. Experiments have shown that destroyers and larger ships will be sunk or very heavily damaged by an underwater explosion of a 20 KT bomb at a distance up to 900 m, and smaller vessels at even greater distances. At a distance of 1,400 - 1,500 m from the center of the explosion, electronic and other light equipment will suffer damage, and the engine equipment may be damaged slightly. But the underwater shock is only one of the dangers to which the ships are exposed in case of an underwater atomic explosion, since even insignificant damage in the ship's hull caused by the underwater shock wave may become the cause for the destruction of the ship under the subsequent effect of air shock, winds, and the waves which accompany the shallow underwater explosion.

During the explosion of a 20 KT bomb in shallow sea, more than 1,000,000 m^3 of water and matter from the bottom of the sea are displaced, which creates a great danger for the crew, because these particles are highly contaminated, and may be blown to considerable distances by the wind.

Within a radius of 4-5 km from the center of the explosion, the sea water becomes highly radioactive, forming a danger for the health and life of the crew, especially during the first 15 hours after the explosion. By precipitation, dilution of the radioactive sea water by sea current, or by natural disintegration of the radioactive particles, the contamination of the sea quickly decreases, whereas the radioactive particles sedimented along the coast line may represent a great danger for a considerably longer period.

Understandably, in case of the explosion of larger bombs, the radius within which the ships will be damaged, and the side effects of the atomic blast will be greater, which can be calculated with sufficient accuracy by means of appropriate formulas or tables prepared for this purpose.

The optimum height for the aerial explosion of a 20 KT bomb is 500-600 m. Similarly to an explosion over land, the high atomic explosion will effect an air shock and heat and radioactive radiation. The only difference in the manifested effect of an aerial atomic explosion over flat land and that over the sea is that the induced radioactivity of the sea water may be neglected.

It is assumed that vessels larger than a destroyer will be sunk at a distance of up to 600 m from the place of explosion of a 20 KT atomic bomb; up to 800 m, they will be heavily damaged and immobilized; light damage may be expected to a distance

of up to 1,900 m. If we compare this with the damages caused by an underwater explosion of an atomic bomb of the same force, we can conclude that aerial explosions are more dangerous for lighter naval forces, and the underwater ones for large and armored ships.

The way of using poison gas against targets on the sea is essentially different from their use on land. A contamination of the sea surface is out of the question, since the water rapidly absorbs and dilutes almost all poison gases. Even if this were not the case, the contamination of the hull of a ship at the water level alone would have practically no effect on the combativeness of the contaminated ship. For this reason, only the direct contamination of a ship is effective, which cannot be achieved easily in view of the dimensions of ships, their speed of sailing and maneuver, and the vast maneuvering space which the open sea affords.

There is a very limited choice for the application of chemical warfare against targets at sea. Spraying poison from an aircraft is effective only from low altitudes and at low speeds, in a direct sweep over the ship. It is obvious that with the anti-aircraft armament of the war ship, such an attack represents a very risky undertaking.

The use of chemical aircraft bombs and artillery shells is feasible, but a direct hit is necessary, and the question is whether it would not be more effective to use destructive projectiles.

A poisonous smoke screen would be effective, but it limits the maneuvering space of the attacker as well. Taking into account that a modern war ship is built as a collective shelter against atomic-biological-chemical attacks, we may conclude that the use of poison gas against targets on the sea is not nearly as effective as it is on land. This does not imply that the danger could be ignored on the sea, but only that the possibilities of using war poisons against targets on the sea are limited, and that ships afford excellent possibilities of protection against chemical attacks.

The use of biological agents against ships is ineffective for the same reasons. However, biological and chemical weapons could be used very effectively against naval bases and coast defense units. The climatic conditions on the sea in the temperate zone are favorable for the propagation of most pathogenic organisms. On the whole, the meteorological conditions in the maritime part of the front are usually more favorable for biological-chemical warfare than inland areas on the same latitude. Therefore, and because of the great importance of naval bases for every country, it is to be expected that these bases will be a target for all possible ABC weapons, individually or in combinations, depending on the objective of the attack. This also means that ships will be in greater danger of an ABC attack while at the bases than when performing combat tasks on the open sea; it is harder for the ships to defend

themselves against, or to avoid, ABC attacks in harbors than it is on the open sea.

Observing the enemy, gathering information about resources, intentions, and ABC weapons, the meteorological situation, and other factors which influence the possibility of using ABC warfare, and its effectiveness, are first requirements for a successful ABC defense.

Although the sea offers optimum technical possibilities for observation, early detection, and reporting of any ABC danger, there still exists a great problem in this respect even for the greatest and technologically most advanced naval forces. Today it is possible to send guided missiles or heavy bombers carrying atomic bombs against targets several thousand kilometers distant from the home base of the enemy, which cannot be observed, at speeds from one to over ten thousand kilometers per hour. The US is trying to solve this problem by constructing a system of radar stations at a distance of 100-200 nautical miles from the coast, and they use the same principle on ships equipped especially for the protection of its striking force of aircraft carriers. But, as the Americans themselves admit, even this system does not afford a satisfactory solution of the problem, and in order to secure the time necessary for undertaking any effective countermeasures, this curtain should extend over an additional several hundred miles.

Naturally, this system cannot be applied in smaller seas, and smaller countries with more modest possibilities and a different geographical situation cannot use this type of protection against a sudden attack of the enemy. But the principle "to detect the ABC danger as early as possible and to report it as soon as possible" has become the goal toward which everybody is striving according to the respective conditions and possibilities. In order to realize this objective, it is very important that observations be carried out in an organized and planned fashion, by all units, continually, day and night, in all combat situations, by all available means, along the entire width and greatest possible depth of the sea front. Since the possibilities for extending the range farther out from the coast are limited in smaller seas, it is necessary to seek additional ways and means of avoiding a sudden attack. These are, for instance, a greater readiness of the ships, dispersion, use of natural shelters where possible, depending on geographical conditions, building the least profitable targets (which is accomplished by building smaller warships), etc.

The principle of quick concentration and deconcentration, which is applied by all navies in the world, is closely related to and dependent on the detection and reporting service. Owing to their speed and great maneuvering space, warships have excellent possibilities for fulfilling these requirements. However, dispersion of ships in case of ABC alarm is possible only if the ABC observation and reporting service functions so that it will protect

against sudden ABC attack, leaving sufficient time from the moment of detection of the enemy until his approach for the re-arrangement of ships from a congested to an antiatomic formation. When ships are in the harbor or at anchor, the situation is different from the situation when sailing. In the former case, much more time is needed for dispersion. Among other things, the time needed depends on the number of ships in the harbor, their size, readiness for sailing, and maneuvering space in the harbor. In the other case, when the ships are at sea, they only need to change their formation in order to avoid the atomic attack. In this situation, the size and type of the ships and their assignment have a definite influence; therefore, when discussing this problem, we must differentiate large naval units (such as aircraft-carrier groups, which require a special form of dispersion) from small units which, due to the size of ships and assignments, have a better chance of surviving.

All navies are devoting much attention to the ABC defense of ships and crews. As a result, an increasingly large number of low ships with rounded surfaces without sharp edges and high superstructure are being built in order to resist as much as possible the air shock of an atomic explosion. Special attention is given to the strength and compactness of the ship's construction, its streamlined form, and the reinforcement of all parts sensitive to air or underwater shock. Refractory material and paint which are used increasingly reduce the danger of heat radiation in an atomic explosion, and the possibility of a fire. Hermetic sealing of the ship's compartments and the construction of "gas citadels" with internal communication between all important departments of the ship, the regeneration of air and the automation of controlling the ship from the inside, and especially the automation of the control of engines which cannot run without external air, have made the ship a safe enough collective shelter for the crew. The rooms inside a ship offer reliable protection for the crew against war poison in the form of drops, against the heat effect of an atomic explosion, and, depending on the construction of the ship, distance, type, and force of the atomic explosion, against air shock and partially against radioactive radiation. If the rooms within the ship are hermetically sealed, they afford protection against poison gases, solid and aerosol particles of war poisons, and biological and radioactive precipitates as well.

The decontamination of ships represents a specific problem, It is known that such an extensive and complex task as the ABC defense cannot be performed solely by special ABC units, but all military units must be trained in the basic and most important operations in this respect. This is particularly important for the navy, since ships may be exposed to the action of enemy ABC weapons on the open sea far from the bases and ABC defense units. The space on ships is too limited to allow a sufficient number of sailor ABC

defense specialists direct the work on detection and decontamination on shipboard, and the entire crew must be trained in the partial decontamination of the ship within their respective combat units. The objective of this partial decontamination is to eliminate radioactive particles or war poisons at least to the extent of not endangering those who handle the ship's armament or equipment.

The complete decontamination of a ship is much more difficult than the decontamination of any other instrument of warfare. Especially difficult is the internal decontamination of the engine, steam pipes, condensers, evaporators, and cooling installations operating with sea water. In general, the methods of decontaminating ships are unique, demanding special equipment and operations which are not applied in other branches of the armed forces (such as sand blasting, vacuum cleaning, decontamination with overheated steam, fire, corrosive chemicals, etc.), which demand specially trained units, i.e. teams of skilled shipyard workers and navy ABC defense specialists. Therefore, complete decontamination of ships is possible only upon return to the base, and often it will be more expedient, due to the great amount of time required and the difficulty of the job, to put the ship out of commission until the contamination recedes to a harmless degree by natural disintegration of the radioactive particles.

Since contaminated ships may represent a danger to the men in the base units and establishments, they are assigned roadsteads at a safe distance from the shore.

Because the decontamination of the engine installations, particularly of cooling and other installations which operate on sea water, is exceedingly difficult, contaminated waters should be sailed only in exceptional cases when for any reason it is not possible to avoid them.

It has been mentioned that in shallow underwater explosions of atomic bombs the ships are endangered by the subsequent precipitation of radioactive particles, and at smaller distances also by the waves caused by this explosion. The height of the waves in the case of a 20 KT atomic bomb is 14 m at a distance of 600 m, seven meters at 1,200 m, and four meters at 2,400 m from the zero point. This means that beyond the damaging distance, the waves do not represent a serious danger. But the subsequent precipitation of radioactive particles which can be carried by the wind to a distance of 100 km or more is a different matter. Therefore, the avoidance of the after-effects of an underwater atomic explosion is the concern of the ABC defense also. If the combat situation on the sea does not require otherwise, ships should go against the wind and in the direction opposite to the place of explosion.

Although a biological warfare attack by the enemy against ships on the sea is unlikely, it is possible indirectly from the

shore, either via contaminated insects and animals, or via food or drinking water, or by causing an epidemic among the population in the harbor cities, etc. Therefore, ships are forbidden to enter harbors or to take in supplies in places where an epidemic, a seat of infectious disease, or a radiological or chemical contamination has been reported.

The possibility of spreading infection from shore to ship, especially via insects and animals, besides the greater danger of a possible atomic explosion, is another reason why anchoring near the shore should be avoided whenever possible.

There is no doubt that one of the most important measures of the ABC defense on the sea is the selection of the sailing and combat formations of the ships and the timing of their action.

The principle "March separately and fight together" doubtlessly corresponds best to the requirements of modern warfare. However, in striving for deep echelons and dispersed formations one must not go into extremes and neglect the requirements of defense against classical warfare.

As far as the selection of the time for action is concerned, it is well known that night and adverse meteorological conditions hamper ABC warfare, and this should be borne in mind.

One of the more serious problems faced by most navies is the ABC defense of the coast defense units. The solution of this problem varies, depending on whether the units in question are within the defense range of important and profitable targets (such as naval bases, etc.) which would, therefore, fall under more comprehensive ABC protection with the participation of a specialist, or whether they are coast defense units scattered along the coast and on islands. The communication, command, and supply of these units have always represented a problem, and now there is the added problem of ABC defense. Since it is unlikely that an ABC defense specialist will arrive in time, even under optimum conditions, these units must be equipped for self-defense. Reliable and inexpensive measures are the building of shelters for the men and the supply of these units with equipment for ABC detection and decontamination of persons and material. Since the units are stationary, it is possible to build shelters and baths for the men in good time, and the supply of decontamination equipment and reserve clothes would not pose any particular problem. Thus the units would be equipped for self-defense against ABC attack even better than ship's crews, and the work of the ABC defense specialists would also be made easier, as the unit would have to rely on them only for the decontamination of clothes, food, water and, in exceptional cases, of the terrain.

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